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SURGICAL TREATMENT OF FACIAL PALSY BALLANCE-DUEL METHOD.†

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Had I followed a strictly logical order for the development of the subject before us tonight, I should have shown these clinical cases of facial palsy—surgically treated by the introduction of autoplasmic grafts into the gaps made by removal of injured portions of the facial nerve, following the lantern and moving picture demonstration of the work on animals, which finally led up to this method of treatment.

However, since such an order would have necessitated keeping these patients waiting such a long time, I have hazarded the possibility of producing an anticlimax with my audience, against the comfort of the patients. I shall defer further talk about them until later.

I wish now to show you a series of lantern slides and moving pictures, illustrating some of the work on animals in which Sir Charles Ballance and I have been collaborating for the past year and a half at my country place; to be followed by motion pictures showing various stages of the progress of these patients, before and after operation. I shall also show a moving picture of a case of double Bell's palsy with partial recovery.

†This article is a report of the presentation made by Dr. Arthur B. Duel before the New York Academy of Medicine, Section of Otolaryngology, Nov. 25, 1931.

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My great regret tonight is that Sir Charles is not with us to present to you—so much better than I shall be able to do—the development of this operation which, but for him, would never have been attempted, or even conceived.

Most of you know something of the career of Sir Charles. He has been a research man from the very beginning in connection with his very busy surgical life. His early monograph, "A Treatise on the Ligation of the Great Arteries in Continuity" (1891), is classical. For years Surgeon-in-Chief to St. Thomas' Hospital in London, he found time to always be interested in the major surgery of the ear and its intracranial complications. His work, "Some Points on Surgery of the Brain" (1907), has always been a guide book to me. His "Essays on Surgery of the Temporal Bone" (1919), I think you will agree with me, is the finest ever written on the subject.

I first met Sir Charles at St. Thomas' Hospital in London in 1904. I saw him do a few radical mastoid operations, using his own method of skin grafting. I saw him do one of his early hypoglossal-facial anastomoses for facial palsy. I came home full of enthusiasm, which has never waned. Well, after that, for a number of years I used to make a yearly pilgrimage to the shrine of St. Thomas! Then there was a long period (I now realize that it was all too long) when I did not see him, although I kept in touch with the brilliant things he was doing.

As you know, he was in supreme charge of the surgical work in the Mediterranean during the Great War. At Malta alone he had 29,000 beds under his supervision. He was knighted for his distinguished service and received so many other distinctions that I cannot possibly recall them now. I saw him again after many years in 1928 in London*.

Many of you were present at the demonstration and talk given by Sir Charles. A large monograph was published in the *Archives of Otolaryngology*, January, 1932, giving the details from which Sir Charles spoke. I need hardly tell you what a wonderful privilege it has been and what a wealth of experience I have gained from this work with such a fine old wizard as Sir Charles. I should have been content to sit at the feet of Gamaliel and assist him where I could.

*When he was here in January, 1929, he invited me to join him in a research to develop a method of curing facial palsy that would not be marred by the usual associated movements following restoration by anastomosis operations. You may well imagine my enthusiasm for such a project. A few months later it was made possible by generous contributions from several personal friends, and four foundations, the Carnegie Corporation, the Milbank Foundation, the Lillian Babbitt Hyde Foundation, and the New York Foundation. After a year's work, we reported our progress to the American Otological Society at the meeting on June 20, 1931.

I told him this; he would have none of it. He decreed that from the beginning we should operate alternately.

We operated probably more than 150 times, anesthetized over 200 animals and obtained 150 specimens which Sir Charles is now having prepared for microscopic study at the Royal College of Surgeons in London.

Moving Pictures and Lantern Slides: I show you Sir Charles at leisure; Sir Charles at work. The animal house and the laboratory. A series of anastomoses with every possible—and some well-nigh impossible—nerves. Many of these were repetitions, done many times over to confirm or refute previous experiences of Sir Charles. Lastly, a series of 24 autoplasic grafts, varying from 1 to 16 m.m. in length, in the facial nerve. These were in baboons, monkeys and cats. I show you pictures of many of these baboons exhibiting perfect recovery of the face without any associated movements, such as you see in these other cases in which recovery has taken place following various anastomoses.

I show you various stages of progress in the baby from beginning motion of a few muscles to almost complete recovery. In the woman: at first—complete palsy: no response to Faradic current; impossible to close eye. Later—slow closure of the eye: motion of the lip and lower eyelid under mild Faradic stimulation: beginning recovery. I show you a complete palsy: for future reference. A girl with double Bell's palsy—partial recovery: for future reference. Lastly, eight pictures taken from Bell's classical work, depicting different emotional expressions: pain, anger, laughter, fear, madness, jealousy, etc.

The details of all the anastomosis work will soon be published, and I have not the time to allude to it tonight. I simply wish to bring out the fact that we set out primarily to discover some method of restoring the facial function without associated movements. We were getting toward our goal when we began to get facial movements through anastomosis with a sensory nerve; but when we got facial movements by a graft from facial to facial, we had solved the problem.

We then used many different nerves: reversed facial graft, intercostal graft, descendens-noni graft, cutaneous graft; and lastly, external respiratory nerve of Bell graft. The last seemed so satisfactory that we repeated it over and over—different lengths, different animals, different technique—in all, 24 trials. There were no failures. Any nerve, any length (up to 16 m.m., which was the longest we tried in animals) restored the face in from three to six months. We

felt quite sure that the usual repair in injury cases would not be more than 5 or 6 m.m.

Then came the opportunity, as I have shown you, of trying it on humans. The first case required a 27 m.m. graft, the second a 16 m.m. graft, and the third a 25 m.m. graft. I am looking for a short, easy one; *i. e.*, short injury, with only a short elapse of time before repair is made.

It seems to me that we have demonstrated, however, that where the loss of function in the muscle has not lasted so long that there is complete atrophy, the introduction of an autoplasmic graft of any nerve is likely to restore function to the muscles, without any associated movements such as occurs when anastomosis is employed. How complete and how early a recovery will be achieved we cannot say from our present experience; but the length of time which has elapsed since the injury, and the length of graft required to bridge the gap, must be the important factors in this problem.

Now I am not going to attempt to speak learnedly of what happens in these grafts. There certainly is a degeneration and a regeneration. The graft certainly does not become necrotic where success takes place. Yet there may be, and probably is, an entire degeneration and regeneration of the nerve cells—the graft only acting as a stroma (a supporting structure) for the rebuilding of the nerve tract.

They say that "fools rush in where angels fear to tread." I certainly am no angel and I'm only going to be just fool enough to start this ball rolling; for we have here for this discussion Dr. J. Ramsay Hunt, who has done some real philosophical study on nerve tracts; and Dr. Charles A. Elsberg, who has had a wide experience in their surgical repair. I should like to hear from them.

I hope that Dr. Hunt will explain to us his conception of the "neo- and paleokinetic levels" and their connection with facial expression. It may be that a repair, which is sufficiently good for voluntary motion of all the muscles of the face, may not carry with it the subtle nuances of expression which light up the countenance as in the pictures I showed from Sir Charles Bell. Thus it may be that these perfect results in animals, who require facial motions rather than expression of emotions, may be duplicated in humans only insofar as the grosser expressions are concerned. It may be that the serenity of the Madonna, the cupidity of Shylock, the resignation of the martyr, the exaltation of the trained musician listening to the perfect rendering of a Beethoven symphony, the cold indifference of your banker when you strike him for a loan in these hard times, and a hundred other nuances of expression may not be brought out through a repaired nerve, however perfectly repaired.

We can only wait and see. But, in the meantime, we may rest assured that when a nerve has to be repaired, direct repair, by an autoplasmic graft, is obviously a much better method than indirect repair by anastomosis with another nerve.

CLINICAL CASES PRESENTED BY ARTHUR B. DUEL.

Case 1: This child at eight months of age is the first human on which I operated for relief of facial palsy by the use of an autoplasmic graft. She was brought to my clinic at the Manhattan Eye, Ear and Throat Hospital suffering from a suppurating ear and a large postauricular subperiosteal abscess. She was assigned by the admitting surgeon to an assistant surgeon for operation. He in turn, thinking the case such a simple one, turned it over to the house



Case 1. (A) At time of nerve-grafting operation, March 18, 1931. (C) 101 days later.

surgeon to operate while he stood by. Both learned much about the anatomy of the mastoid, in an infant, from subsequent events.

A free and generous incision was made, the bone thoroughly curetted and the patient returned to bed. The following day the surgeon informed me that there had been noted a complete left facial palsy from the time of recovery from the ether. I was much chagrined that this should have happened on my service. "It's an ill wind that blows nobody good," however. The following day I operated the case. Sir Charles Ballance was present, consulting.

In the bottom of a suppurating wound, after long search, I found emerging from the posterior border of the parotid gland about 2 m.m. of the divided facial nerve. A mild Faradic current applied to this stump caused a violent spasm of all the left facial muscles (the reaction of degeneration had not yet taken place in the ramifications of the distal branches of the nerve). The divided proximal end was

found at the level of the horizontal semicircular canal. The intervening portion had been curetted away. The measured distance between the divided ends was 27 m.m.

Consulting with Sir Charles, we concluded that the chances of a nerve graft of that length living, in a suppurating wound, were slight. On the other hand, the same danger confronted an anastomosis if done at that time, in addition to exposing a dangerous area in the neck to infection. The longest graft we had used in an aseptic wound in baboons had been 16 m.m., and we had looked forward to injuries not usually involving more than 5 m.m. of nerve.

It seemed probable that we should have to look forward to an anastomosis with the hypoglossal or glossopharyngeal, after complete healing of the wound, for eventual restoration of the face. However, there was the great difficulty of finding the stump of the facial in the neck, with the resulting scar. We felt that if left to heal before attempting an anastomosis, the stump would have to be identified by a silk thread passed through it, or by being wrapped in dentist's gold. It then occurred to us that, if a graft were used, the silk suture through the stump would serve to identify it for an anastomosis later on in case the graft did not live. Therefore, why not take the chance of trying the graft?

Accordingly, 27 m.m. of the external respiratory nerve of Bell was laid on the bone and muscle between the divided ends of the facial nerve. It was merely laid against the proximal end in the Fallopian canal. The bone had been removed about 4 m.m. above the protruding end and the fibrous sheath slit up. One strand of 000000 black silk (Davis & Geck) held the distal end to the graft. A platinum sheet, formed into a cradle, covered the whole length of the graft to protect it from the dressing.

The dressing was of strips of sterile gauze moistened with normal salt solution. This was changed daily for two weeks, the platinum cradle being carefully removed and replaced in order to observe the condition of the graft. The graft always remained pink and evidently healthy. Granulations gradually enveloped it. In two weeks the nerve was deeply embedded in healthy granulations and the platinum cradle was permanently removed. The postauricular wound filled in with healthy granulations and was closed by a plastic operation at the end of a month.

In six weeks the child began to use its facial muscles. The distortion gradually disappeared. As you can now see, about eight months after operation, the child, in repose, looks perfectly normal, moves all its facial muscles, the eyes close synchronously, on crying and

laughing the facial movements are perfect on both sides, although not absolutely synchronous. We think that in a year the difference will hardly be noticeable. On the whole, we are much elated over the success of this new operation.

Case 2: Mrs. B., age 34 years; mastoid operation, right, eleven months ago in Jersey City, followed immediately by complete facial palsy of right side. Referred to Dr. Marvin Jones' Clinic at the Post-Graduate Hospital, who referred her to the Manhattan Eye, Ear and Throat Hospital for operation by Sir Charles Ballance and myself.

There was no response to Faradic stimulation in any muscles on the paralyzed side. There was a faint response to strong Galvanic stimulation in some of the muscles around the mouth and eye. The facial nerve was exposed from the posterior border of the parotid



Case 2. Before operation, June 25, 1931.

gland to the stylomastoid foramen, by dissection of the soft parts; and from the stylomastoid foramen to the geniculate ganglion by removal of the bony wall of the Fallopian canal. There was a dehiscence in this canal, caused by the mastoid operation, from the level of the oval window to within a few millimeters of the stylomastoid foramen. In place of the nerve, there was a long area of granulation and scar tissue.

After a clean division of the nerve at the proximal and distal ends and removal of the scar, the gap measured 30 m.m. The fibrous sheath of the remaining nerve was slit, up to the geniculate ganglion, and down to a few m.m. beyond the stylomastoid foramen. A graft of about 18 m.m. (the cut nerve always shrinks) was cut from the external respiratory nerve of Bell and placed, without sutures, in

the gap, the ends impinging on the proximal and distal ends of the facial. A layer of unrolled dentist's gold was placed over this. The wound, left wide open for daily inspection, was dressed with sterile gauze moistened with normal salt solution. This sounds very much as if this had been accomplished with perfect ease. As a matter of fact, Dr. Marvin Jones, who heroically stood by for more than four hours, can attest to the fact that the difficulties encountered had well-nigh exhausted both our patience and physical endurance before we had finished.

However, the patient is here and, as you can see, bids fair to reward our efforts with a result which, while it probably will not be as perfect as the child's, nevertheless encourages us to never despair.

In two weeks the graft, which had from day to day looked healthy, was covered in with firm granulations. At about this time, the patient began to speak of feeling a "fluttering" sensation in the lower lid when she attempted to close the eye. Within two months she began to visibly move the orbicularis palpebrarum. She can now slowly close the eye, as you can see. She sleeps with her eye closed tightly. She declares that this alone is sufficient compensation for all she has undergone.

About a month ago (four months after the nerve graft had been implanted) an anesthetic was administered, for the purpose of doing a plastic operation to close the posterior wound and improve the scar. This gave us an opportunity to use a Faradic current much stronger than she was able to bear. To our amazement and delight a strong Faradic current, over the main trunk at the level of the stylomastoid foramen, caused a *strong contraction* of all the muscles of the face.

We are, therefore, hopeful that in the course of a year she may have a fairly straight face in repose, and that she may have sufficient voluntary control to do away with the grotesque appearance shown in the moving pictures taken before operation. She already begins to move the muscles under faint Faradic stimulation. We hope to show her to you in a year or so with a much improved face.

Case 3: Mr. F., age 28 years, referred to me by Dr. John R. Page. Eleven months before, one of his assistant surgeons removed a large ivory-like exostosis from the posterior canal wall on the left side. He also removed, with it, the Fallopian tube and facial nerve, downward, to within a few millimeters of the stylomastoid foramen, and up to and including the horizontal semicircular canal; probably also the stapes (I could not find it). There was immediate facial palsy, loss of hearing and static sense on that side. The wound was dry.

There was no Faradic response in the muscles. There was only a slight response in some of the muscles to a strong Galvanic current.

We operated without much hope of success. The proximal end was found just at the geniculate ganglion; the distal end just inside the stylomastoid foramen. The sheath of the nerve at the distal end was slit open nearly to the posterior border of the parotid gland and the nerve cut off squarely inside the sheath. The measured distance between the divided ends was 25 m.m.

Failing, after a prolonged search, to find the external respiratory nerve of Bell, I took a 25 m.m. graft from a cutaneous nerve in the arm-pit to bridge the gap. The wound was infected; the graft did not live. A month later, when the wound was clean, I took two lengths of intercostal nerve from the lower border of the sixth and seventh ribs and placed them in position; they both lived. It is only three weeks since these grafts were implanted. It will be many months before we shall know if there is any success. The grafts are living and I hope to show him again with a report of his progress.

135 East 64th Street.

ZONES OF THE SKULL OF MAXIMAL AND MINIMAL SOUND PROPAGATION: HEARING THROUGH THE SKULL AND HEARING THROUGH THE TELEPHONE.*

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In testing different parts of the skull for their capacity to transmit sound, under normal conditions of hearing, it will be found that the site of maximum conductivity, both with reference to intensity and duration, is the teeth of the upper maxilla especially, over the central incisors. This applies to all the forks that are capable of sound propagation through bone.

The next area of optimal transmissibility is shared equally by two separate zones on the temporal bone. One is on the mastoid, directly back of the ear, at a point corresponding approximately to the location of the antrum, and the other is on the squama, directly in front of the ear, a little above the place where the root of the zygoma merges with the squamous portion of the temporal bone. Unlike the teeth which are the site of greatest conductivity for all frequencies, the two areas on the temporal bone differ in this capacity with the different frequencies of the forks employed. Thus, the low-pitched forks 32 (C_2), 64 (C_1) and 128 (C), will be heard better in front of the ear; while the forks of middle and high range, 256 (c_1), 512 (c_2), 1024 (c_3) and 2048 (c_4), will be heard better in back of the ear.

The best way to demonstrate the propagation of sound, by bone conduction, of the last named fork, is by placing its stem against the teeth or the mastoid and closing the opposite ear by pressing the palm of the hand against it. The sound of the fork will be distinctly heard in the occluded ear, by bone conduction, for some time after it is no longer perceived, from these locations, by air conduction.

The site of minimal conductivity, for all frequencies, is about equally shared between the glabellum and the inion and the adjacent vicinities, in a vertical direction.

The conductivity of the rest of the skull occupies a position intermediate between these, in varying proportion, depending upon the particular zone and the pitch of the fork used.

While, as it was pointed out, the teeth are the area of the greatest sound propagation, there is a circumstance connected with this opti-

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mum transmissibility which is worthy of note. It is the fact that dental occlusion or nonocclusion either strengthens or weakens the fork sound as heard from the teeth, depending upon the frequency of the fork employed for the test. All forks from 32 d. v. to 256 d. v., inclusive, will be heard better with the teeth of the upper and lower jaws separated; while the forks from 512 d. v. to 2048 d. v., inclusive, will be heard better with the teeth in contact.

B. Prolongation of Bone Conduction in Obstructive and Conductive Lesions: Before considering the subject of prolonged bone conduction in certain diseased conditions of the ear and in those produced by artificial obstructions of the external meatus, it is in order to preface the discussion by a brief statement of some basic principles connected with bone conduction in general.

It is the writer's contention that bone conduction is a modified or indirect form of air conduction¹. When the skull is agitated by a sound-producing object the vibrations do not directly excite the intralabyrinthine structures concerned with auditory perception, but they enter the inner ear and produce auditory sensations in two ways when the structures of the tympanum are intact and functioning. 1. By activating the air contained in the external and middle ears and this, in turn, producing vibrations in the drum membrane which are carried by the ossicular chain to the fenestrae and thus enter the inner ear (craniopneumotympanic conduction). 2. By the bones of the skull directly transmitting their vibrations to the tympanic membrane and ossicles and these vibrations are borne into the labyrinth through the two windows (craniotympanic conduction). When the drum and ossicles are destroyed by disease or removed by operation, the vibrating air of the outer and middle ears transmit their vibrations directly to the inner ear, via the oval and round windows. From the above description it becomes evident that the agitated air in the meatus and tympanum is the only or chief factor concerned in the process of hearing by bone conduction.

The prolongation of hearing by bone conduction in obstructive lesions and in obstructions artificially produced depends upon two established mechanical principles². 1. The same volume of air, when agitated by a vibrating body, will respond with greater force when confined in a closed cavity than in an open cavity. 2. The intensity and duration of the air vibrations in two closed cavities of unequal size will be in direct proportion to the dimensions of the cavities.

It is customary, in otologic literature, to use the terms "conductive" and "obstructive" deafness synonymously or interchangeably, yet there are some essential differences between these two conditions

—anatomic, pathologic and, in their *modus operandi*, in the production of prolonged bone conduction.

The term "conductive deafness" should be used only in connection with lesions affecting and confined to intratympanic structures which interfere with audition, such as the drum membrane, ossicular chain, intratympanic muscles, the lining of the cavity, and the two fenestrae; while "obstructive deafness," as the term implies, should be reserved only for conditions confined to the external ear which impair the hearing by causing partial or complete occlusion of the external meatus, such as malformations of the pinna and meatus, atresias, exostoses, tumors, edemas and foreign bodies in the external ear canal and, likewise, to similar conditions of the Eustachian tube which tend by their occlusion to convert the middle ear into a closed cavity by shutting off the tympanum from communication with the external air.

In obstructive conditions, it will be found that the impairment of hearing and the prolonged bone conduction bear a direct and definite ratio to the degree of obstruction. The more complete the obturation, the greater is the loss of hearing and the more prolonged is the bone conduction, and *vice versa*.

While the prolongation of bone conduction due to obstructive conditions in the meatus and auditory tubes is a true phenomenon and lends itself to a logical explanation based on well established physical principles, namely: 1. when the skull is agitated by a vibrating body it imparts its vibrations to the air contained in all the skull cavities; 2. the air in a closed cavity will respond more powerfully to these excitations than that in an open cavity; 3. the air in a closed cavity of greater dimensions will vibrate with greater intensity, when agitated, than in a cavity of smaller size—the reason for increased sound propagation through the skull, in conductive lesions, is not known, and the phenomenon itself is only an apparent one, as proved by Knudsen and Jones³ when testing for it in a soundproof room.

Lastly, obstructive conditions of the ear can be duplicated artificially and studied under ideal conditions.

C. Prolongation of Bone Conduction in Artificial Obstructions: When a finger is introduced tightly into the ear canal there follows impairment of hearing and increased conduction on the side of the occlusion. These, in all respects, are like those produced by obstructive lesions. When the finger is slightly withdrawn, the sound of a tuning fork, in contact with the skull, will become more marked. The reason for the difference in the intensity of the sound as experienced by change in position of the obturating finger, as advanced by

Kerrison⁴ is that when the finger is tightly held in the ear canal it causes increased intralabyrinthine tension and therefore a diminution of sound perception follows, in accordance with Gellé's test, as compared with the increased sound when the finger is held lightly in the ear. This explanation is not altogether correct. The difference in the intensity of the sound, with the shifting of the position of the finger, is rather explained on the basis of greater and smaller size of the closed cavity into which the meatus is converted by the finger. When the ball of the thumb is pressed tightly against the introitus of the meatus, resting on the tragus, the fork sound will be heard still better than with the finger lightly resting in the canal. And finally, when the palm of the hand is pressed against the ear, completely shutting off the canal, the fork sound, by bone conduction, will be heard best, both as to intensity and duration. It is readily observed from this that the prolongation of sound conduction follows, with equal steps, the increase in the dimensions of the shut-off ear canal. When the finger is introduced tightly in the meatus it encroaches much on the air space in the cavity, hence a weaker sound is produced. As the finger is slightly withdrawn, permitting of a greater volume of air to be set in vibration, the sound becomes stronger. When the thumb is held in front of the meatus the sound is heard still better and, lastly, when the palm is held against the ear not only does it not encroach on any of the meatal space but it adds the space of the cavities of the concha to that of the meatus and thus converts it all into one large closed cavity, hence the maximum degree of sound perception by bone conduction.

As mentioned above, the teeth are the area of greatest conductivity, followed by that of the two zones of the temporal bone. But as in the latter, where either zone is the better conductor, depending upon the different frequencies of the forks employed, so with the palm of the hand pressed against either ear, the teeth or the opposite mastoid, from that of the closed ear, will prove the location of optimal sound propagation, depending upon the pitch of the fork used for the test. It will be found that all forks from 32 d. v. to and including 256 d. v. will be heard better from the mastoid, and forks 512 d. v. to 2048 d. v. inclusive will be heard better from the teeth.

The best results obtained in the palm test will be by using fork 512 d. v. This fork when used against the teeth with the palm against the ear will give a negative Rinne in normal conditions of hearing.

D. Hearing Through the Telephone: It is a well known fact that people who suffer from conductive deafness, who find it difficult

to follow ordinary conversation, will yet hear conversation quite well over the telephone. The reason adduced to explain this phenomenon is that these unfortunates are assisted in this wise by means of bone conduction, by pressing the telephone receiver against the deafened ear. Not only do they hear by air conduction alone, it is contended, but also by cartilage and bone conduction. That these people are aided by bone transmission, however, is only partly true. The voice, as heard via the telephone receiver is capable of being transmitted quite readily by the skull, as can be demonstrated by the following experiments: 1. Press the open face of the receiver, when in use, against any part of the skull, while closing one of the ears tightly, with the palm, and the voice of the speaker will be distinctly heard in the obstructed ear. In the same way, press the receiver against the mastoid, opposite to that of the occluded ear and not only the voice will be heard in the closed ear, but one will at times be enabled to follow the conversation through the bones of the skull, depending upon the enunciation of the speaker and the distance between the speaker and listener, remove the hand from the ear with the receiver still applied to the mastoid, and the voice will be lost altogether or will be heard faintly, on the side of the receiver. Thus it is seen that the vocal vibrations are carried through the skull by crossed conduction to the opposite side. 2. With the receiver pressed against the skull of a subject, apply your ear to the opposite side of his skull and the examiner will perceive the sound of the voice by transvibration—the voice of the speaker being carried, via the subject's skull, to the examiner.

The chief reason, however, why "conductives" hear better over the telephone is that by pressing the receiver against the deafened ear they unwittingly convert the ear canal into a closed cavity and thus the vocal vibrations being poured into this cavity are capable of exciting the contained air confined in this space to greater activity than is possible in the open canal. That this is the real cause of their improved hearing can be proved by duplicating the conditions that obtain in hearing by telephone in the following manner: Close one ear with the palm or by cupping the hand over it, so as to completely close off the underlying auricle and meatus from contact with the surrounding air. Now pass one end of a soft rubber tube through the fingers of the obstructing hand, into the closed space, so that the end will rest either in the aural concha or at the mouth of the meatus. Care must be taken not to compress the tube by pinching it between the fingers and to close up the space around it as much as possible so as not to permit a communication with the external air,

and not to bring the open end of the tube against any structure in the external ear so that there is no interference with sound transmission. Insert a vibrating fork in the distal end of the tube or apply it externally to any part of the tube and the sound of the fork will be quite loud in the obstructed ear. Slightly remove one part of the hand from contact with the skull so the aural cavity communicates freely with the external air, and the fork sound becomes markedly decreased. Replace the hand and the sound again becomes intensified. With the hand against the ear and the tube in the same position, apply the distal end of the tube to the mouth and blow a current of air inside the cavity, while doing this remove one part of the hand from the skull and observe the difference in the intensity of the air current in the closed cavity and the open one. One will find the difference quite marked. Into the distal end of the tube insert a glass funnel and whisper into it or let someone else talk into it and observe the change in the intensity of the vocal vibrations when the canal is open or closed. Apply the glass funnel (with the tube attached to its stem) to the ear, covering it completely, so as to convert the space of the inverted funnel and that of the external ear into one closed cavity. Now pour sounds—voice, fork or any other—via the tubing, into the ear. The sounds will be heard more intensely when the ear is completely shut off than when some air is permitted to seep in by partly lifting the funnel at one point.

This last experiment duplicates closely the *modus operandi* of sound perception, by conductives, via the telephone.

SUMMARY.

The teeth are the site of optimal bone conductivity.

The glabellum and inion are the sites of minimal bone conductivity.

Conductive and obstructive deafness are two distinct conditions.

The palm against the ear, especially with the 512 d. v. fork against the teeth, furnishes the maximum expression of prolonged bone conduction.

Conductives hear better over the telephone because by pressing the instrument against the ear they convert it into a closed space.

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THE TREATMENT OF CHRONIC MIDDLE EAR INFECTION.*

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The interest in any research study is largely conditioned by the difficulty in its solution. This difficulty as a problem and its vital practical importance to every clinical otologist are sufficient reasons for this informal presentation. A review of current literature is convincing as to its place in major research today, a place perhaps only shared by its leading competitor, progressive deafness.

The title, "chronic middle ear infection," seems innocent enough, but leads into such an amazing complexity of interpretation that precise definition is impossible. This chronic infective discharge may have a most varied etiologic background; in character it may be constant, intermittent, variable in type and degree, periodic in association with other systemic conditions, frank or as insensible as surface perspiration. It may be the sequence of an otitis neanatorum, or a true suppurative otitis media, infantile or adult, from tubal origin. It may be associated with sclerotic, diploetic or mixed type of mastoid change; it may be associated with cholesteatoma or sequent to fulminating coalescent mastoiditis; specific, tuberculous, neoplastic and varied bacterial conditions may modify the picture. Both acute suppurative otitis media from transient tubal and nasopharyngeal infection and the thrombotic type in the exanthemata, which should normally subside, under rational treatment, should be excluded from the discussion.

It is my purpose to discuss simply and directly the problem of ordinary chronic infection, true otorrheas and intermittently discharging ears, first outlining the etiologic factors in anatomic and pathologic background and then attacking frankly the problem of eliminating infection with the least damage to the individual and his hearing, and the least sequence of tinnitus and vertigo.

Of the three titles, anatomy, pathology and treatment, in present day discussion anatomy alone is stable, pathologic views in various laboratory centers are widely variant and there is a wide gap between the conservative palliative measures in treatment of the infected middle ear advocated by otologic authority we must respect and the

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prompt radical procedures of equal authority at the other end. Progress, however, is evolved through independence, disagreement and frank discussion. The views of this paper, based on present experience but subject to change, will be offered frankly, and equally frank controversial opinion is invited in the discussion.

The middle ear must anatomically contain the tympanic cavity, Eustachian tube and mastoid process. Infective involvement of one is reciprocal with the other two. The mucosa of the Eustachian tube and, at least, the antrum of the mastoid share tympanic cavity infection in the acute stage and continue in the chronic until such time as blocked off by pathologic change.

Have often quoted the expression in Dr. Fetterolf's under-graduate course of lectures, "for its relative size the mucus-lined tympanic cavity is responsible for more human distress than any of the other air-containing cavities of the human body."

The otologist's interest in the tympanic cavity is only limited by his intimate acquaintance with it. Three areas are of consummate importance to him; the tympanic membrane, the ossicular chain and the mesial surface with its five important points, the promontory marking the lowest turn (highest tone perception of the cochlea), the oval window above and round window below, the covering of the facial canal and the prominence over the external semicircular canal. This mesial surface can be wounded by the paracentesis or incisional knife, is in immediate contact with infective fluids in the middle ear, is vulnerable to traumatism and injury in careless removal of foreign body, and in case of thinned wall, bony dehiscence or semipatulous squamomastoid fissure, of meningeal consequence. This middle ear adds importance to the question of tinnitus by the presence of the antagonistic intratympanic muscles, the tensor tympani and the stapedius, and to vertigo in the stapes foot plate and oval window relation to the vestibule.

The anatomic contribution to the problem of infection occurs through the ready formation of scleroses, adhesions, hyperplasia of the walls, narrowing of the depth through retraction of the tympanic membrane, enhanced by the small drainage outlet through the Eustachian tube. This cavity has abundant blood supply through the stylo-mastoid, tympanic branch of internal maxillary, internal carotid, ascending pharyngeal and middle meningeal. Its veins empty into the middle meningeal, pharyngeal plexus and internal jugulars; its lymphatics into the retropharyngeal and parotid nodes. Such vascularity favors prompt repair but is equally disastrous under forced retention of inflammatory products. This space is so closely lined with mucous

membrane epithelium that this constitutes the periosteal layer, in which organized patches of exudate are but a step from erosion and bone necrosis. These thinned walls favor absorption, and dehiscence in tegmen or floor favor intracranial invasion. It is well to remember how frequently infection has followed the latter route directly to the bulb and explained mysterious blood stream infections where the conventional lateral sinus thrombus is missing.

You are, of course, familiar with the intricacies of the attic cavity and Prussak's space, the ligamenture of the malleus and incus, the anterior and posterior commissural folds, the subcellar space in the tympanic cavity extending below the level of the external canal, a retention area of importance. Some interesting studies were made by the writer in company with Dr. Gardner¹, of the Frazier Clinic, on the vascular infiltration in the tympanic membrane and seepage into the tympanic cavity appearing in a considerable percentage of cases following the section of Gasserian root in middle fossa, in the "tic" operation.

Pathology: In the chronic suppurative stage we are concerned with a cavity increasingly filled with exudative granulations, polypoid protrusions, perhaps cholesteatomatous masses from ingrowing canal epithelium, an infected attic area so blocked by ossicular and tympanic adhesions and ligaments that the drainage may be but an irregular and tortuous sinus.

Splendid work has been published by Almour², Kopetzky² and others based upon the earlier teachings of Wittmaack, and their views will be quoted freely in this discussion. If these be accepted, much of this whole story of pathology can be traced back to infantile changes long before the immediate fight with infective discharge. One cannot disregard the primary channel of entrance through the Eustachian tube. This is fundamental in the entire picture. The school which follows Emerson's³ advice in clearing out the adenoid mass in the nasopharynx at the time of mastoid operation has an increasing membership. The removal of nasopharyngeal obstructions and foci of infection is amply justified. It is unfortunate, however, that damaging changes to the lumen of this Eustachian tube have already become permanent before such effort has been induced, and no amount of treatment by bougies and intratubal applications will repair the pathologic constriction to drainage.

Passing from the conventional anatomic to the pathologic side of the picture, this discussion ceases to be dogmatic. Much is still a matter of opinion but no field could be of more absorbing interest than the pathologic variation in the infected tympanic cavity and its

relation, past and present, to the mastoid process. With the influence of the Wittmaack school, our whole conception of this pathology may be changed, and the future chapters on the rôle of the cholesteatoma and mastoid surgery seem likely to be rewritten. Histologic and pathologic changes in the middle ear so deeply concern the treatment of subsequent infection that the closest analysis of the factors struggling for supremacy in natural repair is justified. One must not only consider what can be done to eliminate the infection, but also what may happen if the condition is let alone and allowed to get well.

According to recent views, the tympanic cavity, attic and antrum are primarily filled with embryonal connective tissue, covered by delicate epithelium. As aeration first takes place, this pushes down from the mastoid antrum into the adjacent mastoid cells, and pneumatiza-



Fig. 1. Principal steps in modified attic drainage.

tion of tympanic cavity, antrum and mastoid cells occurs with compression of this high embryonal tissue. With its contraction occurs sinking of the epithelial covering. This normal pneumatization replaces the marrow content of the mastoid and leaves the bony trabeculae lined with contracted connective tissue and thin covering of epithelium. Quoting from Almour: "The normal process of pneumatization consists of three stages; first, the ingrowth of subepithelial connective tissue into the marrow spaces; second, the contraction of the subepithelial tissue, and third, the sinking in of the epithelial covering." Two infantile conditions halt this pneumatization: one, first cited by Aschoff¹, the otitis media neanatorum, due to early respiratory forcing of meconium or other foreign substances into the middle ear. This is inflammatory, not suppurative, and continues until foreign material has been absorbed or encapsulated, but during the process the middle ear, including mastoid, becomes filled with hyperplastic connective tissue, halts the pneumatizing process and

leaves the mastoid cavity sclerotic, sometimes hardening to eburnized state. The other condition of infancy is the true suppurative otitis media due to bacterial invasion from Eustachian tube or perhaps from the infected external canal through blood and lymph streams. The sequence of this is fibrosis with marked contraction of the sub-epithelial embryonal connective tissue. This halts the pneumatization at its existing stage, leaving the mastoid cells, in part or whole, in bone marrow or diploetic stage. Both the sclerotic and the diploetic mastoid prevent the acute coalescent mastoiditis, which would normally follow an active middle ear suppuration, from extending into a pneumatized mastoid. We are not concerned now with the hemorrhagic, thrombotic type of mastoiditis but with presence or absence of sclerotic change favoring the development of a chronic otorrhea in the one case; a coalescent mastoiditis in the other.

Another concern rests in the catarrhal type of infantile otitis. Post-tympanic presence of hyperplastic tissue seems responsible in large degree for the tympanic, ossicular and posterior wall adhesions which sometimes wall off the anterior portion of the tympanic cavity and leave the posterior attic and antral area subject to cholesteatomatous action.

Perforations are of special interest in three phases, all bearing on the squamous-celled epithelial invasion from the external canal—the large central type, the lateral wall opening and the small Shrapnell's perforation, which first dimples, then makes tiny opening too small for outward passage, with squamous-celled invasion of the tympanic antrum.

In the first, central type of perforation, the inflamed tympanic mucosa and the squamous-celled epithelium from tympanic and canal surface actively proliferate, and battle against each other until they meet. The opening has in the process been widening, is finally rimmed with scar tissue and discharge ceases. In the second, the marginal type, there is a powerful sweep inward of squamous cells, replacing rather than covering the inflamed mucosa, with a grayish white fibrous covering, and a dry ear results. The masses of squamous cells may accumulate, however, in such quantity as to form, combined with other detritus, the so-called cholesteatoma. In the process of this second stage, the inflamed elevations of tympanic mucosa with granular polypoid appearance do not usually represent bone necrosis and radical mastoid interference is not indicated. The third type occurs when the tympanic antrum becomes walled off from adhesions present after infantile otitis. Air is absorbed, the tiny Shrapnell's area dimpling, as described by Bezold⁵, bursts, and the

small Shrapnell's perforation appears. It is too small to allow the squamous-celled invasion easy egress, cholesteatomatous tumor-like mass is formed, by pressure encroaching on antral space. Vascularity and additional cell tissue is drawn from vessel walls in the bony tissue and tumor mass fills and gradually enlarges the cavity, causing underlying bone necrosis. These processes, it will be seen, are associated with the sclerotic or eburnized change in the mastoid.

This paper is on the treatment of the ear with chronic infection and the introduction of so much pathology may be questioned. The understanding and interpretation of this pathology is, however, the initial stage in treatment; all this represents Nature's effort at reparative process and is basic in the campaign of treatment. It would be better to continue the palliative irrigation, antiseptic lotion and powder than to proceed surgically without a clear indication for it. Much of the discouragement in ossiculectomy and radical mastoid proce-

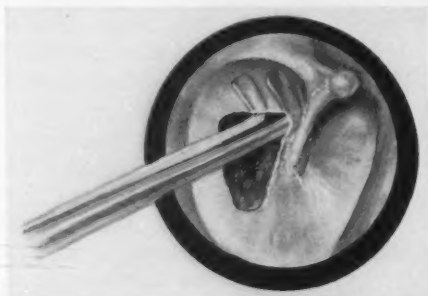


Fig. 2. Principal steps in modified attic drainage.

dures would seem to be based upon failure to differentiate between processes epidermatizing tympanic mucosal surface and walling off of destructive process, from factors producing further degenerative stage. This pathologic theory is not original and probably not completely proven, but it is a comfortable basis to work upon and the modified surgical treatment adapted to it has been sufficiently successful to justify it. The report of Crowe and Polvogt⁶ on embryonic tissue in the middle ear and mastoid in later life, finding mesenchyme in tympanic cavity and mastoid antrum in two persons over 50 years of age, does not preclude the sequence of infantile otitis as outlined above. It would seem worth while to try to translate this complex and technical background into more simple terms of procedure; in other words, make this pathology basic in our treatment.

Visualize, if you please, that new patient in the treatment chair with chronic discharging ears for a period of months or years. This ear has presumably been under considerable treatment by family physician, other specialists or patient himself. A reasonable allowance must be made for disturbance in the tympanic picture incident to this. Two things will help in the pathologic interpretation; one, the history of ear troubles in earliest childhood, and the other, history of intermittent periods of quiet with the establishment of acute nasopharyngeal coincidence in fresh outbreaks.

This ear under examination presents one or more perforations, though these are not always easy to see. These perforations usually fall into one of the groups mentioned: the large central type, the marginal wall opening and the small high perforations high in anterior or posterior quadrant. The large central type probably represents true tympanic mucosal infection and most likely of tubal origin, and study of the appearance of its margins will indicate how closely Nature's proliferating effort of inflamed mucosa and the squamous-celled activity have come to meet and terminate the active process. Perhaps sufficient intratympanic view through perforation will be permitted to make out the grayish white changes of the posterior wall.

The immediate pathologic search should next determine the blood indication of the activity of infection. Kopetzky⁷ has emphasized such blood studies as the routine continuance of erythrocytes and hemoglobin estimation, McKernon's⁸ balance line in the ratio of leukocytes to total neutrophile count, and the comparatively modern value of the "staff" or immature polynuclear cell count, the so-called "shift to the left," which might advantageously complement the routine laboratory report. Mild blood stream infections, missed on both solid and liquid media, are frequently present and concern the decision as to how much to do with chronic suppurative otitis media, especially the border line cases. Time does not permit to more than mention the valuable information from blood sugar examination in the deceptive mastoiditis of the diabetic and the importance of the lumbar puncture in threatened labyrinthine and meningeal invasion.

The next step is the X-ray diagnosis of the mastoid, pneumatic, diploetic and sclerotic types, not to omit the petrous pyramid. Nothing is more germane to this pathologic analysis than the successful diagnosis of the sclerotic mastoid. If present, it indicates that the tympanic cavity has been subject to the changes following infantile catarrhal or infantile suppurative otitis. These are so distinctly correlated that it is my belief that our treatment and surgery must be profoundly affected by it. The diagnosis of the tympanic picture,

the blood study registration of infective acuity and the accurate Roentgen interpretation of the mastoid area should make the pathologic index for treatment a complete one.

Case reports are the most instructive factors in clinical study but for presentation in paper, the most uninteresting and monotonous. Brief comments will be informally made on some interesting events occurring in a half dozen cases, but not formally incorporated here. The question of bacterial organism will not be reviewed in this paper. The field of chronic infection is a contaminated one and it is doubtful whether studies in acute otitis media have been productive. The streptococcus, both hemolytic and nonhemolytic, have become friendly and the mucosus capsulatus to be dreaded. Aschoff and Fuld⁹ reported surprising necropsy findings in 100 children who had died

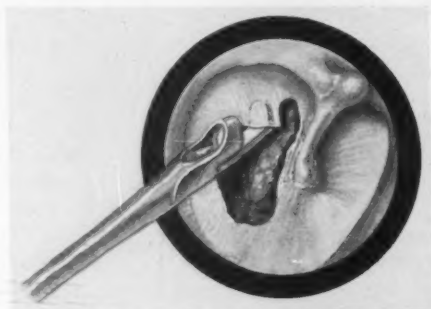


Fig. 3. Principal steps in modified attic drainage.

without clinical symptoms of otitis; four-fifths of these had otitis media, and in 77 per cent the pneumococcus was found.

Treatment: As introductory to each treatment, I would like to emphasize certain premises: 1. Each ear should be first viewed in the light of its future service to the individual in hearing; 2. such viewpoint does not disregard the fact that chronic suppurative infection is a chronic focus of danger, and may become an acute focus; 3. Nature is helping assiduously to cure this ear and our procedures should be co-operative ones; 4. there is no human mechanism quite so marvelous as the machinery of the middle and inner ear—the finest machinery is injured most easily; 5. the concealed results in the recesses of the ear do not palliate operative offense, though the results of damage may not appear for months or years.

The treatment must commence with a careful analysis of five sets of factors: 1. The exact interpretation of the tympanic area, mem-

brane and tympanic cavity; 2. the conditions in the nasopharynx and their contribution to the middle ear infection; 3. the diagnosis of conditions in antrum and mastoid; 4. the infective state in the external canal and its epithelial wall; 5. in doubtful cases, Bárány review and lumbar puncture. Assuming that the middle ear presents a *status quo* picture, a persistent purulent discharge without pain accompaniment or evidence of toxic metastasis, complete and thorough removal of all crusts and secretion without producing artificial vascular changes, is first in order and early culture might be of value, though the infection is doubtless a mixed one. The importance of blood study has already been covered under pathologic consideration. The tympanic membrane should be studied for its stage in tissue change, hypertrophy, atrophic sequence, blood vessel appearance, especially in neighborhood of annulus and down along the malleus handle. All possible indications of post-tympanic adhesions, sclerosis in Shrapnell's area, mobility in both tense and flaccid areas, should be noted.

As already stated, perforations present a varied consequence, according to position, the frank opening in central area or lower outer quadrant; the low anterior perforation adjacent to Eustachian tube which is persistent in activity; the marginal wall opening, whose significance has already been described; the small deep excavation near or involving the short process, simple in control and relief of patient's discomfort, but obstinate against permanent cure; the high, perhaps almost pinhead perforation in upper outer quadrant, suspecting a walled off tympanic antrum and formation of cholesteatomatous tumor.

The early study is in the nature of planning a campaign and should not be a hurried one. As the diagnosis of intratympanic pressure in acute infection is aided by the presence or absence of view of the short process, line of malleus, tympanic vessels and light reflex, so chronic infection is guided by secondary effect marked in tissue, vascular changes of the drum membrane, and the glimpsed appearance of the tympanic mucosa.

Nasopharynx and Eustachian Tube: The major percentage of middle ear infections have originated in or passed through the nasopharynx. It would be futile to campaign against middle ear infection when its source, and source likely to repeat, has not been eliminated. It is not appropriate to go into nasopharyngeal detail in this ear talk, but a simple review may not be inappropriate. First in importance is the adenoid, Luschka's tonsil. The entire Waldeyer ring, including the lateral tonsil masses and the tubal adenoid tissue, which exists

under the mucosa of the cartilaginous tube as a well developed layer of lymphoid tissue, are consequential. This tubal tonsil is particularly well developed in children. Emerson's⁸ emphasis of adenoid influence in middle ear infections has previously been noted. Adenoids are of more obstructive and infective significance in tubotympanic disease than the faucial tonsils. It does not seem to have been appreciated how much the adenoids share the chronic bacterial infection popularly copyrighted by the faucial tonsils. In studies of adenoid tissue after removal, they have been found to contain pathogenic bacteria in 100 per cent of cases analyzed. In one reported investigation, hemolytic streptococci were present in 61 per cent, pneumococci in 65 per cent, and Klebs-Loeffler bacilli in 12 per cent of cases. The adenoid has several pendulous folds with deep clefts,



Fig. 4. Principal steps in modified attic drainage.

typical culture beds for bacteria (protection, moisture, food, and even temperature). When operating under direct vision with rubber catheters to retract the palate or direct vision specula, one can observe the conditions from simple cryptic exudate to actual chronic abscess. Renner¹⁰ has described Tornwaldt's disease, pharyngeal bursitis and cysts of the bursa pharyngea, an infective source here of some importance. It is not pertinent to review the varied focal elements, teeth, sinuses, etc. Certain things like the septum-ethmoid complex in a crowded upper nares with diseased posterior ethmoid encroaching upon the tube mouth have a definite impress upon tubotympanic infection. The nasopharynx must be cleaned up as a premise to rational ear correction. In determining tubal patency, Bordley¹¹ used

the ingenious method of blowing a collodion bubble on quill to be inserted, just filling external auditory canal. The motion of swallowing was accompanied by play of iridescent colors on collodion film, indicating tubal opening.

External Auditory Canal: The great controversy as to moist and dry treatment of middle ear acute infection has a considerable bearing upon the presence of mixed infection in the canal and the probability in irrigation of washing in as much and more infection than is washed out. By the same corollary, any external auricular channel contribution to middle ear chronic infection should be removed. Chronic eczematous infection, latent furunculosis and hair follicle infection should be eliminated. This may require much trouble as both middle ear and canal infection are often correlated, each reinfecting the other. Cure of actual canal infection is not so simple, and may require, besides the simple routine antiseptics, yellow oxid, etc., vaccines, stock or autogenous, nutritional reorganization, including yeast and cod liver oil, and tonic medication. Exostoses are troublesome visitors in the external canal, causing block and accumulation of detritus.

Mastoid Contribution: We have much to learn on mastoid X-ray interpretation. The time will come when the diploetic, sclerotic, pneumatized mastoids and petrous tip infections can be placed in their respective stalls and labeled. The mastoid is part of the middle ear, at least the antrum is involved in every acute middle ear infection. If so in the acute case, it must be a thoughtful phase in the chronic. A middle ear infection should not subside unless an active mastoid infection has adequate drainage. It is not wise, however, to inform patients that such and such an infection cannot get well without operation, for now and then they do, and it is disconcerting.

It has already been indicated that the utopian goal will be reached when external inspection and palpation, tympanic observation, X-ray differentiation, minute leukocyte studies, etc., can make the decision as to surgical interference a definitely safe one. At the outset, would like to put myself on record as believing the mastoid operation in careful hands is even safer than a tonsil enucleation.

After adjusting this side etiology, the treatment of the middle ear infection resolves itself into methods of local treatment, fortifying of constitutional background, including vaccines, intratympanic increase of drainage, or some form of mastoid surgery.

The examination of tympanic area should have determined the status of Nature's effort in repair. Simplest forms of nonirritating care to favor such action are advisable, as the simple boric acid and

alcohol drops, the retention for 15-minute periods of diluted reagents like metaphen and the use of the Sulzberger or other forms of iodine powder. The questionnaire replies in the Harkness review of otolaryngologic progress for the year, published in the December *Annals*, will give a fair crossline of opinion on this special powder, though the proprietary phase of this is disturbing. While it is not absolutely certain that many ears would not recover under the careful cleansing, drying and application of alcohol alone, much help has been derived from iodine powder, not only in ears but in other chronic ulcerative areas in the nose. One essential point has been emphasized by Kopetzky in a recent conversation: iodine powder must reach the infected area, and even with a minute perforation this powder must reach the tympanic cavity. Poor drainage presents the same problem here as in other surgery. It is far less dangerous to increase a perforation, even opening a lower drainage, than it is to allow the suppurative process to continue with formation of adhesive bands and scleroses. Wagers made a careful report on the results of conservative measures, mercuric solutions, colloidal silver, ultraviolet rays and ionization, indicating that even in most careful hands and upon most co-operative adult patients, scarcely more than half were cured and that with most patient routine care. Constitutional reconstruction is a most important adjuvant in these cases, but requires adequate co-operation from the patient. It is appropriate, I think, to allude to the work which is being done by a nutritional group of some twenty-five otolaryngologists under the leadership of Jarvis and the late James Stucky. It is very evident that there are nutritional regimes which may be definitely therapeutic and that there are diagnostic aids in the regulation of these. Many patients are on the verge of alkali and acid ash disaster, as was brought forth in a recent paper by Jarvis in New York and will be developed in a symposium at the forthcoming Triological meeting. Much is evidenced by the color index of the nasal septum and probably other mucous membranes. This nutritional balance in diet is somewhat of a fad at the present time and affords lucrative returns to certain organized sanitaría. There is, however, more in it than popularity: certain definite regulations, scarcely onerous, will counterbalance this systemic imbalance and reduce the tendency to suppurative secretion, even bronchial tendencies. Have had remarkable success in combatting both this and atypical neuralgia, sinus affections, migraine, etc. It would be extravagant to venture the statement without further demonstration, but am convinced that much can be done in the subjection of tinnitus aurium and staying the progress of progressive deafness through

nutritional regulation. Perhaps the round table discussion of this paper will bring out some of these facts and gain proof for the statement.

It seems fair to take this position in regard to the treatment of conventional chronic intratympanic suppuration. After adequate local study, removal of contributing nasopharyngeal factors, the tympanic area should be treated conservatively for a reasonable length of time. This conservative treatment might include a liberal test of iodine powder and free drainage both from drum membrane and pharyngeal Eustachian orifice should be obtained. If the condition has been of long duration and shows no indication of response, would strongly advise the minor surgical measure of modified attic drainage as recently published, with the definite reservation that a limited group of cases have osseous necrotic change of such degree that much more radical measures will be required and certain cases will not result in sufficient drainage to eliminate the deeper involvement in antrum and adjacent cells of the mastoid. The procedure is so simple and, thus far, free from serious complications that it is worth trying. It is gratifying to frequently find that after a few minutes of light anesthesia, sufficient outer and upper quadrant drainage may be established to relieve and quiet ears with long continued and foul suppurative discharge. The hearing has generally been improved, tinnitus lessened and in some cases apparently cured. A few have reconstructed almost normal drum membranes with restoration of a light reflex, indicating smooth surface. This should always be done, with the proviso that more radical measures may be necessary. Such radical measures should even then be conservative and not disturb the sclerotic and eburnized portion of a mastoid. Some such surprising results will be informally quoted, and we urge its trial and suggestions for better technique.

Ossiculectomy is an old procedure. Most otologists have been enthusiastic for brief periods, perhaps have had two or three relapses of enthusiasm and then discarded it. The reason for ossiculectomy is an uncontrollable middle ear infection. The logical procedure seems to be to clear out everything in the attic cavity. Malleus, incus and sometimes stapes have been removed, the whole area cleared of adhesions and curetted, often with distressing drop in hearing, vertigo or even labyrinthine suppuration. Then, in the majority of cases, follows the failure to produce dry ears. In the first place, one is working in a blind pocket, in a constricted, highly vascular field, one in which packing or other retaining procedures cannot be followed. If the field is completely cleared, floor is replaced by firm fibrous

tissue, often with underlying bone disease, crusts and scales form from small amount of secretion present (remember, this is primarily a mucus-lined area), vascular anastomosis is poor and the walls tend to collapse and bind the space down. This is perhaps the reason for discarding the method.

The radical attic method of Tobey¹², which opens into the antrum and adjacent mastoid via the attic route, the methods of Lempert, Blackwell and others in partial radical procedure, the complete radical mastoid of Morrisset Smith, have been approved by many, but in most hands the radical operation has fared as ossiculectomy. Ears are not always dry, hearing is lowered and there is always the menace of the seventh nerve injury.

It was upon the basis of these observations and one oft-repeated fact, that in the series of changes following active middle ear inflammation and suppuration, the drainage downward through the attic area into tympanic cavity, frequently becomes but a tortuous thread-like passage, that the writer¹³ became interested in a modified attic procedure, and as this middle ear infection topic was chosen by your committee, the liberty to discuss this may be assumed.

The following facts were premised: 1. At least the antrum of the mastoid is involved whenever the middle ear is infected and this retains the infection most tenaciously. 2. There must be a favorable outlet if this infection is not to persist and burrow destructively into the bony surrounding walls. 3. The oft-discussed disease of the ossicles should have as good a chance at self-limitation as any other body tissues if not under continued impaction and obstruction. 4. Hearing will be best preserved by the retention of as much natural structure as possible and in normal position. 5. This whole area has shown conclusively an inclination toward spontaneous recovery.

It seemed logical to believe that a simple effort to square up this drainage in a fairly safe area for surgical approach, the posterior superior quadrant of the tympanic space, might be successful. As far as known, this procedure has not been discarded by those who have given it a careful trial; my own results have shown that a majority will be successful. Accidents may happen, but can be avoided. Even incomplete results give some measure of relief and hearing has seldom been lowered. As stated, this procedure will not always be successful, but should do no harm.

Procedure: The drainage should be made directly up from the outer half of the ear to the mouth of the iter ad antrum, and the opening a generous one. The danger in large tympanic opening is an inconsequential one; the danger lies in the disturbance of the

stapes. As Battson stated in an interview, by all that is reasonable, the incostapedial joint should give way before the foot plate in the oval window is disturbed. The latter evidently happened in two of my cases, perhaps a third, and the patients had a bad time with vertigo, fever, reaction, etc., for some days, but eventually recovered, one with a dry ear and perfectly reformed drum, the other with a still persistent discharge and granulation tissue. The ossicles are not intentionally removed, but are simply pushed aside and allowed to reassume middle ear function in, sometimes, slightly altered position.

Regardless of position of perforation, operation is begun in outer inferior quadrant, adjacent perforations are enlarged into this area, but if too small and distant are disregarded and a new opening made in the above site. The opening is carried up beneath the scutum, the attic area reamed out by lateral movements of a small right-angled probe, portions of the upper membrane or even scutum are punched out to give a free drainage opening. Then an oblique-angled curette is carried up and into the entrance of the iter ad antrum, its margin curetted free of granulations and strip of iodoform packing is gently placed in tympanic area. There is, of course, much resemblance in this to the old form of attic curettage; adepts with that curette could do most of this without further armamentarium. As published in a previous report, with the help of Prof. Battson, of the Graduate School (who prepared necropsy material, lifting out the brain and exposing the tegmen tympani), it was demonstrated that this oblique-curved curette passes exactly into the iter ad antrum, misses danger to cranial cavity, seventh nerve and the stapes. This procedure predicates a sclerotic or, at least, diploetic mastoid in background and such are somewhat hard to recognize by X-ray. You are all aware how often a mastoid diagnosed as diseased by Roentgen plate proves to be eburnized almost to marble hardness; that type of mastoid does not usually require mastoid surgery, but its antrum often does need drainage, and this type of procedure will procure it most simply.

It is most difficult to avoid over-emphasis on one's hobby in procedure. This becomes peculiarly difficult where research effort has to be so closely linked to the routine of professional practice.

As previously stated, some leaders in our specialty claim and honestly believe that palliative measures will equal all that surgery can accomplish in this tympanic field; others advocate the radical methods. Somewhere between these extremes belongs the partial pro-

cedure, with its equally earnest adherents. It is hardly possible that any of these decided views can be right all the time.

Repeating in conclusion, in the treatment of chronic middle ear infection, the first procedure is a careful analysis of the tympanic field; second, the evaluation of nasopharyngeal, tubal, auricular canal and mastoid contribution; third, the persistence of routine cleansing, antiseptics, persistent trial of the iodine powder, cauterization and other methods co-operating with Nature's effort. Fourth, the final consideration is either attic drainage, simple mastoidectomy or the radical operation.

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1912 Spruce Street.

ORAL IMMUNIZATION AGAINST PNEUMOCOCCUS MENINGITIS.*

DR. JOHN A. KOLMER and DR. K. W. AMANO,
Philadelphia.

In a previous paper¹ we reported the results of experiments upon the vaccination of rabbits against pneumococcus and streptococcus meningitis produced by intratympanal and intracisternal inoculation with highly virulent organisms. On the basis of the encouraging results observed, and especially in active immunization against pneumococcus meningitis, we suggested the possibility of actively immunizing humans against pneumococcus and streptococcus meningitis secondary to paranasal or otitic disease, by the preoperative administration of autogenous vaccines.

As especially encouraging results were observed by the oral administration of vaccines of Type I pneumococcus, we have conducted additional experiments with virulent Types I, II and III, and the results, briefly recorded herewith, have indicated that a high degree of resistance may be produced in rabbits against pneumococcus meningitis by the oral administration of vaccines of *virulent* cultures of these types prepared by various methods.

As stated in our former paper, the idea of using pneumococcus vaccines by *oral administration* was based upon the splendid investigations of Dr. Victor Ross on oral immunization of rats against virulent pneumococci². As shown by Dr. Ross, white rats may be rendered resistant to subcutaneous and intraperitoneal injections of 1,000 to 10,000 fatal doses of virulent Types I, II and III pneumococci by feeding: *a.* the organisms in tissues of animals killed by pneumococci; *b.* by heat-killed organisms in milk; *c.* by acid-killed organisms, and *d.* by sodium glycocholate-dissolved cells and Berkeley filtrates of these. Feeding the soluble specific substance of Types I and III also produced immunity, while the specific polysaccharide of Type II produced little or no resistance. Dr. Ross also reports that encouraging results have been obtained in the feeding of acid-killed pneumococci in the very early stages of pneumonia of humans and his excellent work has given considerable hope for successful immunization against pneumococcus infections. Curiously, however, the feeding of acid-killed degraded avirulent organisms produced little or no protection in rats and indicated the necessity of preparing the vaccines of virulent strains.

*From the Research Institute of Cutaneous Medicine of Philadelphia. This study was aided by a grant from the Daniel J. McCarthy Fund for Research in Neurology.

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METHODS EMPLOYED.

Preparation and Administration of Vaccines: Vaccines of virulent Types I, II and III pneumococci were prepared as follows:

1. Cultures in sterile milk were incubated at 37° C. for 16 hours and killed by heating in a water bath at 60° C. for one hour. The quantity administered was 10 c.c. by stomach tube each day for a week.

2. Cultures in beef heart broth were incubated at 37° C. for 16 hours and treated with "N" HCL acid solution to make a "N/15" concentration and left at room temperature for two hours, at which time subcultures demonstrated that the growth had been killed. The quantity administered by stomach tube was 10 c.c. daily for a week.

3. Cultures in beef heart broth were incubated at 37° C. for 16 hours. Each 50 c.c. was centrifuged and the cocci dissolved in 5 c.c. of a 1 per cent solution of sodium taurocholate. The quantity administered was 5 c.c. by stomach tube daily for a week.

4. With Type I pneumococcus a filtrate was prepared by cultivating the organism in beef heart broth at 37° C. for 10 hours, followed by passage through a sterile Berkefeld V-filter; 10 c.c. of the filtrate was given by stomach tube daily for a week.

Medium-sized rabbits, weighing from 1,700 to 2,000 gm., were employed.

The vaccines were administered by stomach tube each day for a week in doses per animal (not per weight) as above mentioned.

Production of Meningitis: One week after the last dose of each vaccine, the treated animals, along with untreated controls, were anesthetized and inoculated intratympanally or intracisternally with 16-hour heart broth cultures of the respective strains in the following amounts:

Type I—0.6 c.c. of undiluted culture intratympanally.

Type II—0.3 c.c. of 1:80 dilution of culture intracisternally.

Type III—0.3 c.c. of 1:80 dilution of culture intracisternally.

All of the controls inoculated with Types I and II developed meningitis and succumbed in 24 to 72 hours; with Type III, the majority developed meningitis and succumbed in 24 to 96 hours.

RESULTS.

The results observed in one experiment with Type I pneumococcus are summarized in Table I. While all of the untreated controls developed meningitis and succumbed in 24 to 72 hours, from 25 to 100 per cent of the treated animals survived. Particularly good results were observed with the vaccines of sodium taurocholate dissolved and acid-killed organisms and a filtrate of broth culture since from 75 to 100 per cent of the animals survived.

TABLE I—RESULTS WITH VIRULENT TYPE I PNEUMOCOCCUS.

<i>Vaccines</i>	<i>Number</i>	<i>Percentage of Survivals*</i>
Heat-killed milk cultures.....	4	25
HCl acid-killed organisms.....	4	75
Sodium taurocholate-dissolved organisms.....	4	100
Berkefeld filtrate of broth culture.....	4	75
Controls	4	None

*Following intratympanal inoculation with 0.6 c.c. of 16-hour heart broth culture.

The results observed in an experiment with Type II pneumococcus are shown in Table II. All of the untreated controls developed meningitis and succumbed within 48 hours, while 75 to 100 per cent of the immunized animals survived.

TABLE II—RESULTS WITH VIRULENT TYPE II PNEUMOCOCCUS.

<i>Vaccines</i>	<i>Number</i>	<i>Percentage of Survivals*</i>
Heat-killed milk culture.....	4	100
HCl acid-killed organisms.....	4	75
Sodium taurocholate-dissolved organisms.....	4	100
Controls	3	None

*Following intracisternal inoculation with 0.3 c.c. of 1:80 dilution of 16-hour heart broth culture.

The results observed in an experiment with Type III pneumococcus are shown in Table III. The majority of untreated controls developed meningitis and succumbed in 24 to 96 hours, whereas from 75 to 100 per cent of the immunized animals survived.

TABLE III—RESULTS WITH VIRULENT TYPE III PNEUMOCOCCUS.

<i>Vaccines</i>	<i>Number</i>	<i>Percentage of Survivals*</i>
Heat-killed milk culture.....	3	100
HCl acid-killed organisms.....	4	100
Sodium taurocholate-dissolved organisms.....	4	75
Controls	3	33

*Following intracisternal inoculation with 0.3 c.c. of 1:80 dilution of 16-hour heart broth culture.

RECOMMENDATIONS.

These results, along with those previously reported¹, show quite conclusively that rabbits may be protected against meningitis and septicemia following intratympanal or intracisternal inoculation with virulent pneumococci by immunization with seven daily doses of vaccines prepared by various methods, administered by stomach tube. Indeed, the results are far superior to those observed following

immunization by subcutaneous and intravenous injections of heat-killed vaccines¹ and amply confirm the observations of Ross on the immunizing capacity of pneumococcus vaccines by oral administration to rats.

Particularly encouraging results were observed with vaccines of HCL acid-killed pneumococci and sodium taurocholate-dissolved organisms, although the results produced by heat-killed milk cultures were likewise quite good.

As mentioned in our former paper¹, it may be that humans with pneumococcus sinusitis may acquire some immunity by swallowing the purulent secretions, followed by a dissolution of the pneumococci in the gastrointestinal tract.

And even though the incidence of pneumococcus meningitis secondary to otitic and paranasal sinus infections is fortunately low, yet the mortality is very near 100 per cent and under the circumstances it would appear advisable to prepare at least some patients for operation by the administration of pneumococcus vaccines whenever time permits. For this purpose it is recommended to prepare autogenous vaccines of the pneumococci recovered in cultures. Either heat-killed milk cultures, HCL acid-killed or sodium taurocholate-dissolved organisms may be employed in vaccines prepared as described above and it is suggested that the oral administration of 20 to 30 c.c. each day for at least one to two weeks is worthy of clinical trial for pre-operative immunization.

CONCLUSIONS.

1. Rabbits have been effectually immunized against meningitis and septicemia following intratympanic and intracisternal injections of virulent Types I, II and III pneumococci, by the oral administration (stomach tube) of vaccines given once a day for a week.

2. Particularly encouraging results were observed with HCL acid-killed, sodium taurocholate-dissolved and heat-killed milk cultures of virulent pneumococci.

3. It is recommended that when time permits, humans with pneumococcus paranasal sinusitis and otitis be prepared for operative procedures by the oral immunization of autogenous vaccines as a possible protection against extension of the infection to the meninges.

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2101 Pine Street.

END-RESULTS IN SINUS SURGERY.*

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There has been of late years a tendency to criticize unfavorably the results of sinus surgery, as even of nose operations in general. This criticism comes partly from the laity and partly from certain members of the profession. The question is often asked by patients, Is one operation all that will be necessary, or will I have to keep on having operations the rest of my life? That such a question is sometimes justified is an obvious fact which we have reluctantly to admit and is largely due to the tinkering methods which formerly were practiced, especially in the periodic removal of a polyp in a nose which needed some sort of a radical operation. I have known a patient with a record of fifty such so-called operations covering a period of nine years, another one told me of twenty-six sessions with various specialists in which something had been removed. Many of you can easily imagine how these patients with such entertaining experiences could become very militant propagandists in corrupting the mind of the "body politic." I am glad to say I was able to convert these disseminators of false doctrine by doing some radical surgery on their sinuses and effecting a satisfactory cure in both cases. The cause of a skeptical attitude towards sinus surgery in the profession comes partly from the same experience which has affected the lay mind and partly from an ultra-conservative attitude towards surgery in general where it cannot be proved that an operation is necessary to save life. This skepticism may prevail among members of our own specialty and with some it may be a defense complex to alleviate the disappointment of their own poor results.

There is no doubt that the paranasal sinuses present a very difficult surgical field. The anatomy has many variations and the anomalous situation of some cells may render any operation a very perplexing problem; fortunately, an X-ray is a great help in discovering these anomalies and warn us of the difficulties. I feel that it is a fair statement to make that no one should attempt sinus surgery till they have served a long apprenticeship in the dissecting room; not only must they know the anatomy thoroughly, but they must know as much as possible of the variations and abnormalities. There are few

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branches of surgery where operative work on the cadaver is more instructive, and as much as possible of this should be done before attempting any operation on the living. While a thorough knowledge of the anatomy is an absolute requisite, there is also a necessity for the observance of sound surgical principles, and the application of these principles will largely determine not only the indications for operation but also the results. There are certain surgical axioms which must be followed. The first is that, given a pus focus anywhere, this must be given free drainage by the best possible means which the anatomy of the parts will allow. Second, where a progressing inflammatory process must be treated surgically, the whole of the focus should be removed. A partial removal will probably do more harm than good, and the end-result will vary according to the thoroughness with which this removal is accomplished.

Let us examine now in detail the various operations on the sinuses, bearing in mind the above mentioned principles and estimating the results obtained where they are properly observed. We will begin with the maxillary antrum. The simplest and the most common one is the intranasal drainage operation through the wall of the inferior meatus. It is presumably done where the antrum cavity has become a pus reservoir and fails to clear up by its natural drainage. This procedure is entirely rational and in the majority of cases yields a satisfactory result. Persistence of the discharge for a long period may occur and may be due to several causes; such as insufficient drainage due to closure of the opening, polypoid degeneration of the antrum membrane. Low level of the antrum floor below the level of the intranasal opening. In the first group of cases the antrum opening should be enlarged; in the latter case a radical operation will probably be necessary. The situation of the antrum opening is important. This should be made as far back as possible and only a small portion of the lower part of the inferior turbinate needs to be sacrificed. The old operation of removing a portion of the anterior part of the turbinate should be condemned, for while it renders easy access to the antrum it continually becomes reinfected and is subject to irritation and discomfort in very cold weather; besides there is sometimes a very embarrassing loss of control of secretion which does not occur with an opening further back. The reinfection of antra with artificial drainage even in the proper position is fairly common but will clear up with a few irrigations, provided the opening is sufficient. The size of this opening should be made larger than is apparently necessary as it always has a tendency to close too quickly, especially in young subjects; in fact, in

children it nearly always closes and is rather disappointing; persistent patience and enlarging the opening may finally effect a cure. The radical or Caldwell-Luc operation is indicated where there is extension polypoid degeneration of the mucous membrane or where a focus of diseased tissue remains in the floor and continues to discharge in spite of intranasal drainage. In the polypoid cases if every vestige of diseased membrane is cleaned out from all recesses of the antrum, this will yield a satisfactory result in practically all cases. In the cases where a cavity is found below the floor of the nose with a diseased membrane and granulation tissue, it may not be necessary to remove the whole of the membrane, but such cases take rather longer to get well and a period of after-treatment may have to be continued for some time and the portion of the membrane left may subsequently degenerate, necessitating a secondary operation. After the complete removal of the membrane there is a formation of granulation tissue, which eventually covers over with epithelium, though there is not probably any regeneration of a real mucous membrane. On the whole, the complete removal seems to yield a better result than when only partial removal is done. Yet one hesitates to remove a membrane which looks normal beyond a localized pathological area, the antrum seems more prone to reinfection if part of the membrane is left. A few cases even where the membrane has been thoroughly cleaned out will fill up with exuberant granulation and keep up a purulent discharge, rendering secondary operation necessary, but a considerable time, at least six months, should be allowed to intervene, as many unpromising cases will clear up in time. Unpleasant sequelae are tenderness over the scar in the mouth, pain in the infraorbital nerve or disorder of sensation in the teeth. These sequelae are avoidable in most cases. A long incision with gentle retraction is important and separation of the soft tissues should not be carried up to the infraorbital foramen. Very gentle curetting should be done over the apex of the molar openings within the antrum and so avoid any injury to the nerve supply to the teeth.

The intranasal operation on the ethmoids and sphenoids is perhaps the most difficult of all the sinus operations and is the one which probably registers the highest percentage of failures. There is still a belief that a partial operation on ethmoid cells is indicated in some cases; I confess that I have never been able to make such a fine differentiation. I have always regarded a partial ethmoidectomy in the same category with a partial mastoidectomy and most of the bad results I have seen have been due to such incomplete operations. The opening of a few cells, even if one could definitely recog-

nize such a limited pathology, leaves conditions in the adjoining cells where a healing process is almost impossible and would eventually leave some remaining cells with no natural drainage opening. I have seen subsequent complications from this effect and I now believe that the whole labyrinth should be exenterated to obtain a satisfactory result. This is not always possible, for even with one's best effort there may be supraorbital cells which cannot be reached by the intranasal route, yet these cells will usually have fair drainage if the main part of the labyrinth has been cleaned out thoroughly. The sphenoid sinus opening should be enlarged at the same time but unless filled with polypi the membrane inside the sphenoid should be left alone. When the ethmoids have been exenterated, the frontal sinus can usually be entered easily and may be enlarged by scraping the anterior wall, or very often nothing needs to be done to this. If the membrane can be left about the opening it is less likely to close afterwards and too much rasping or curetting to enlarge the opening often defeats its own end.

The healing process after an ethmoid operation takes place by the formation of granulation tissue over the os planum and eventually a layer of epithelium covers the whole part. The granulation should be watched during the healing process and if they become exuberant should be removed with a biting forceps. The opening in the sphenoid should be observed and if there is a tendency for granulation to fill it up these should be bitten away till epithelium covers the edges of the opening. If there has been polypoid degeneration of the sphenoid the whole cavity may have to be scraped out, in which case as large a sphenoid opening as possible should be made. Healing is slow in such cases and infected granulation may have to be removed again. They are likely to form in the sphenoids with a deep pocket below the level of the opening. In one such case I had to bite out the whole floor to give dependent drainage into the nasopharynx. The final result in cases where the after-treatment has been carried out carefully is satisfactory in the great majority of cases. The nasal breathing is very free but the space left in the ethmoid region is not as large as one would naturally expect. The final appearance usually presents a slightly irregular surface covered with epithelium. The base of the middle turbinate shows a slight ridge and in young subjects looks as if there were some reformation of a turbinate; it is even said that there may be some regeneration of the cellular structure, but I don't believe this is probable. The sphenoid opening should have clean-cut edges when completely healed if the mucous membrane has been left in the sphenoid. The opening should not be

too large as the lining membrane is not adapted to too free an access of air. The question is often raised, do these cases have subsequent trouble with dryness and scabbing in this region, and is the removal of the middle turbinate attended with such results? I can truthfully say that I have very rarely seen any such outward result. I have seen such a condition prevail for a time where purulent secretion came down from the frontals and would collect in this region, or where a discharging supraorbital ethmoid cell produced the same effect. With persistent treatment this has usually cleared up and if it did not a radical frontal would be indicated. The effect of crusting and dryness is, in my experience, most commonly due to an incomplete or partial ethmoidectomy. The attempt to remove ethmoids and leave the middle turbinate will nearly always result in an incomplete operation, with the attending unsatisfactory results. Reinfection of these cases is not at all uncommon but they will clear up quite quickly and will yield to treatment far quicker than a nose containing a mass of small spaces where infection can find an inaccessible refuge. Subsequent adhesions can be avoided by always doing a submucous first and taking proper care in the after-treatment.

We will now pass to the consideration of the sinus operation which has been the subject of the most discussions, *viz.*, the radical operation on the frontal sinus. The indications for this procedure seem to become rarer every year, partly due to better intranasal surgery, and partly to the fact that syphilis is treated more promptly and more effectively than formerly. The removal of adenoids and tonsils also tend to lessen the incidence of severe sinus infection. There is always reluctance in advising such an operation on account of the external deformity, and this is especially marked where the sinus is very large; unfortunately, this is the type which is mostly likely to result in complications if not operated on.

The kind of operation is largely determined by the anatomy of the part and this factor also may be a condition upon which a satisfactory result is dependent. If the sinus is small and can be thoroughly cleaned out, it can be easily obliterated without any deformity, but where the sinus is very large and deep, necessitating the preservation of a long, wide bridge, there is always a chance of a blind space remaining under the inner angle of the bridge, which will communicate with the nose and become reinfected. I think it should be emphasized that the end desired in a radical frontal sinus operation is complete obliteration of the sinus cavity; this is attained by the filling in of soft tissue from the orbit to meet the soft tissue from above the bridge. To accomplish this, every vestige of diseased tissue

and all overhang of bone should be thoroughly removed from the edges and the floor. Any supraorbital cell should be thoroughly uncapped and scraped out, even though it may extend over the whole roof of the orbit. It often seems to be assumed that healing takes place after a radical by the epithelization of a remaining frontal cavity with a free communication into the nose. This may occasionally occur but is a far less certain permanent cure, with more liability to reinfection and subsequent trouble. Where the sinus operation has been thoroughly done, on the principle that obliteration is the end desired, the final results are very satisfactory. Practically all secondaries which I have had to do have been due to reinfection of a sinus not properly obliterated or, more commonly, to a supraorbital ethmoid cell not having been completely exenterated. The various modifications of the real radical operation which have been tried are not as a whole successful. The attempt to enlarge the nasofrontal opening by the external route is usually a failure; it necessitates removal of the outer bony wall of the track and subsequently the soft tissue fills in and completely blocks the drainage. The Lynch operation in cases where the frontal does not extend far into the frontal bone and has a long antero-posterior diameter will be worth trying and usually gives a satisfactory result, with no deformity.

Let us now consider the more important results which we have endeavored to achieve in performing these operations on the sinuses. Where symptoms are mainly local, such as complete obstruction from polypi, there should be complete relief in practically all cases if surgery is thoroughly done. Where pain is the chief local symptom, results will not be so satisfactory. There is a type of sinusitis with a sclerosing osteitis which will not be relieved by surgery, but practically all cases where pain is due to locked in secretion can be greatly benefited or cured by providing proper drainage. Where the sinuses are involved as a primary focus of infection, producing general symptoms, draining or removing this focus will give the patients their only chance to clear up their secondary lesions and a large percentage will succeed. Certain failures in this class of case are due to the fact that secondary infection of the intestinal tract from the original sinus infection may keep up the vicious cycle. There are also a few cases in which the local infection will persist in spite of free ventilation and drainage or where anatomical abnormalities prevent any possible satisfactory drainage. This is especially true in anomalous sphenoid anatomy. This condition does not obtain in the antrum, where surgical access is more easy, and many brilliant results may be obtained by operation where antra are acting as a primary focus.

I have seen many cases of arthritis and serious inflammatory lesions of the eye subside very rapidly after cleaning out this focus. The result of sinus operations in asthma cases has been rather variable where the sinusitis is limited and the asthma is not long standing the result is often very good, but many old cases seem to become so sensitized that no benefit is obtained, even though there is a fair presumption that the sinusitis was the original cause. Many other diseased conditions could be discussed in relation to sinusitis and its surgical treatment but time will not permit. I have merely tried to present my brief for this domain of surgery, with the conviction that its results compare favorably with those obtained in any other special field.

101 East 58th Street.

REPORT OF THREE CASES OF DISEASED INOPERABLE TONSILS ERADICATED WITH RADIUM.*

DR. J. COLEMAN SCAL, New York.

The cases here presented were inoperable tonsils treated by radon seeds. The seeds used were small, platinum capillary tubes, 4 m.m. long and 1 m.m. wide, a strong thread being attached to their ends. The seeds were inserted centrally into the tonsils and removed by their attached strings on the fifth day. The amount of platinum filtration is sufficient to exclude the caustic beta rays and thus prevent any necrosis of tissue.

The first case is of a male, age 61 years, first seen June, 1930. He complained of repeated sore throat and slight deafness. On examination the tonsils were found to be enlarged, follicular and almost touched each other when he gagged. Cheesy material was expressed on squeezing. The cervical glands were somewhat enlarged. He refused tonsillectomy and decided upon radium treatment.

On June 24 two radon seeds, each containing 2.7 millicuries of radium emanation, were inserted; one into each tonsil. They were

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removed on June 28. The tonsils decreased in size so that one month later they were one-half their original size. On Oct. 20 he was seen again and the tonsils were much smaller and evident only when the pillars were retracted.

At the present time, this patient's tonsils are practically eliminated, only fibrous nodules being evident. He has had no further sore throat since the insertion of the radium. His enlarged cervical glands are no longer palpable.

Case 2: Male, age 70 years, has had repeated attacks of tonsillitis with joint symptoms for the past ten years. His teeth were all removed, to eliminate the focus of infection. He was seen first on April 10, 1924, at which time his tonsils were hypertrophied and diseased and appeared beefy. Cheesy material could be expressed from both tonsils.

On April 19, 1924, two glass, nonremovable seeds, each containing 0.34 millicuries of radium emanation, were inserted into each tonsil, the total dosage being 1.36 millicurie radium emanation. No reaction followed.

In September, 1924, examination disclosed the tonsils reduced in size to one-third their former size and the joint symptoms, while not entirely gone, were improved. At the present time the tonsils are visible only as fibrous masses. He has had no further attacks of tonsillitis.

Case 3: S. L., age 60 years, has diabetes and joint pains, for which he was taking treatments for a long time. Has had repeated attacks of sore throat. Examination showed his tonsils extremely enlarged, with numerous crypts in which cheesy material was visible.

On Jan. 28, 1927, two removable platinum radon seeds, each containing 2.7 millicuries of radium emanation, were inserted, one into each tonsil. They were removed Feb. 1. A very slight reaction on the right side resulted in the form of a sore throat, but passed off in four days.

He was re-examined March 18, 1927, and the left tonsil was almost three-fourths gone, while the right was one-half gone. His joint symptoms were practically gone. On May 5 the left tonsil was practically invisible, while the right showed a large tab at its lower pole. A similar condition existed on Feb. 5, 1930, at which time one seed containing 3 millicuries of radon emanation was inserted into the remaining tonsil tab at right side and removed on the fourth day. At the present time, the tab is practically gone except for a slight piece of fibrous tissue still evident.

44 West 74th Street.

HYPERTROPHY OF THE LINGUAL TONSIL AND LYMPHOID TISSUE OF THE PHARYNX; REDUCTION BY ELECTRO- COAGULATION.

DR. A. R. HOLLENDER, Chicago.

The lingual tonsil, described as the fourth tonsil in Waldeyer's ring of lymphoid tissue, is situated at the base of the tongue behind the circumvallate papillae and just in front of the epiglottis. The symptoms of diseased conditions in it are frequently overlooked or attributed to pathology in other parts. It is only by careful examination with the laryngeal mirror that pathological states of the lingual tonsil can be discovered. According to Swain¹, pathology in the region of the lingual tonsil demands treatment quite as frequently as in any other portion of the throat and rewards the attention given as no other does.

Compensatory enlargement of the lingual tonsil occurring after faucial tonsillectomy is not always of consequence. If no annoying symptoms occur, it should be disregarded. The symptoms of inflammation, acute or chronic, differ from those of the faucial tonsils only because the masses are in closer relationship to the tongue and interfere with it in deglutition and speech.

The acute and subacute forms of lingual tonsillitis usually respond to sprays and mouth washes. Topical application of mild caustics is effective when the etiology is purely local in character. When these fail attention should be directed to the condition of the teeth and the gums, the use of tobacco, and other possible causes of constant irritation. When the acute inflammation persists for any period of time, and chronicity and hypertrophy ensue, more radical management is indicated.

Surgical removal with the snare is recommended by some laryngologists. The guillotine of Myles is employed more satisfactorily than the snare, but causes more bleeding. Radical excision of the lymphoid masses is advocated by Yankauer and French. The operation is by no means simple and should be attempted only by one who is thoroughly experienced with the procedure. Linear or puncture cauterization of the masses is an effective means of reducing them.

Radium and the Roentgen ray have been employed with fair success. They shrink the lymphoid masses, but sometimes also cause symptoms which characterize atrophic changes of mucous membrane.

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Radiation is a conservative measure of treatment and no doubt is suitable in selected cases.

Mild electrocoagulation has been found to be a successful means of dealing with lingual tonsils which have become hypertrophied. The treatment is similar to that of electrocoagulation of the faucial tonsils. Two to three series of punctures for each mass usually suffice.

Technique: After securing a good view of the lingual tonsil to be treated by depression of the tongue and the use of a laryngeal mirror, local anesthesia of the part is effected by swabbing with a 10 per cent cocain or a 2 per cent neupercain solution. The high frequency machine is set so that when the patient is in the circuit 250 to 300 m.a. are available. The indifferent or dispersive electrode is a metal cylinder held firmly in the patient's hands (or a piece of block tin, 6 inches by 8 inches, placed between the scapulae). A single needle electrode is inserted into the mass at various points. Deep destruction is not attempted. No fear need be entertained of sealing the crypts as sometimes occurs when the cautery is used. The number of needle insertions will depend upon the size of the mass and the desirability of destroying or reducing it in one or more treatments. One lingual tonsil is treated at a sitting. The opposite one is coagulated after the first one no longer causes symptoms. Gray areas of slough will come away within a week, during which period the use of a mild antiseptic mouth wash is desirable.

Case Reports: The following three cases of lingual tonsil enlargement are reported as representative of a series of twenty-two.

W. B., female, age 45 years, married. The faucial tonsils were removed at age of 18 years. No symptoms occurred until forty. The chief symptom then was the sensation of a foreign body under the tongue. This was attributed to neuropathic tendencies, but later, on careful examination, marked hypertrophy of the lingual tonsils was observed. The hypertrophy was reduced from time to time by silver nitrate, antiseptic gargles being employed in the interim. As time went on, the discomfort increased and examination showed the hypertrophy to be more marked. Cauterization seemed advisable and the patient was referred for this treatment. Electrocoagulation was performed instead. Two mild treatments were applied to each lingual tonsil. While only about half the tissue on each side sloughed away, the remaining masses later shriveled up to a negligible size. When healing was complete, the symptoms which had persisted for five years completely disappeared. There has been no recurrence of symptoms after one year.

R. H. B., male, age 30 years, married. Faucial tonsils were removed at age of 28 years. From then on annoying symptoms of

hawking and salivation were present. There was also slight interference with the voice. The right lingual tonsil was markedly hypertrophied and slightly larger than the left. Correction of dental caries did not influence the condition. Four electrocoagulation punctures of the right lingual tonsil and three of the left reduced the masses to less than normal size and eliminated the constant irritation which was previously present. Two years have elapsed without recurrence of symptoms.

W. C. B., female, age 48 years, married. The faucial tonsils were present but the linguals appeared larger than these. They protruded laterally and posteriorly. They could be seen at the base of the tongue without difficulty when the tongue was held to the opposite side. Various remedies failed to shrink the tissue and cauterization was suggested. Instead, the physician, who was a laryngologist, agreed to electrocoagulation. Three rather extensive electrocoagulation treatments were given to each lingual tonsil. The final result was favorable. The tissue on each side was reduced considerably. The symptoms disappeared completely and have not returned after fifteen months.

Comment: Although marked hypertrophy of the lingual tonsil is not common, it occasionally causes annoying symptoms. Conservative measures do not always remedy the situation, necessitating such treatment as cauterization. This procedure has been used more or less successfully, but now may be superseded by electrocoagulation, which is simpler and more effective. No primary bleeding has been experienced, although secondary hemorrhage has occurred when too much tissue was included in a single coagulation.

HYPERTROPHY OF THE LYMPHOID TISSUE OF THE POSTERIOR WALL
AND LATERAL FOLDS OF THE PHARYNX.

Three coats make up the posterior pharyngeal wall: an epithelial layer of the stratified squamous variety, a fibrous, and a muscular coat. The lymphoid tissue is in the fibrous coat of the epithelium. In the tissue of this layer are found the follicles which when prominent are considered abnormal.

The lymphoid tissue of the lateral folds does not differ from that of the posterior wall and is found in the fibrous mucosa. Lymphoid enlargement results from long continued irritation of the glandular structures. Instead of isolated nodules, a column or fold is seen on either side of the pharynx. On account of its position along the lateral wall the fold resembles a reduplication of the posterior pillar. When the nodules of the lateral folds assume macroscopic enlargement they are pathological. Marked hypertrophy of the bands, which sometimes follows removal of the faucial tonsils and adenoids, may

be purely compensatory in nature. As such it is harmless. However, when subacute or chronic infection, or irritation produces objectionable hypertrophy, permanent reduction of the masses by some means is definitely indicated.

Inasmuch as removal of the cause is important, upper respiratory affections should receive prompt and adequate treatment, in order to check postnasal secretions from constantly irritating the pharyngeal wall. A change in occupation is often an essential consideration. Excessive and improper use of the voice may interfere with muscular action and with the blood circulation of the pharynx. Frequent attacks of acute pharyngitis produce chronic inflammation of the mucosa, characterized by hyperplastic changes. In certain systemic diseases, especially of the upper respiratory type, hypertrophy of the lymphoid tissue of the pharynx is not infrequently found.

Hawking is a prominent symptom. This is no doubt due to the fullness of the throat and the clinging secretion on the posterior wall. Secondary symptoms involving the digestive tract and larynx are annoying at times. The voice may become hoarse in protracted cases. A dry, glazed appearance of the throat is observed in cases of long standing.

Treatment: Various remedies have been tried, but most of them give only temporary relief. Ballenger² suggests that in well advanced cases, the lymphatic nodules, whether discrete or massed, as they may be on the lateral walls behind the posterior pillars of the fauces, should be punctured with a cherry-red cautery electrode. Superior to this is the use of electrocoagulation puncture. The technique is similar to that suggested for hypertrophy of the lingual tonsil. No effort should be made to produce deep destruction, and when mild surface electrocoagulation cannot be satisfactorily effected, electro-desiccation should be performed. This is a uniterminal method producing tissue dehydration. The end-result with either method has been found to be quite favorable. If it is deemed necessary, the larger masses of lymphoid tissue are completely destroyed, while the smaller ones are reduced so that they eventually level off with the mucous membrane surface.

The following two cases are illustrative: A. H. M., male, age 35 years, single. The general health of this patient was poor for three years. There was a gradual loss of weight. There was no evidence of chest findings. Careful examination localized the pathology altogether in the upper respiratory tract. The faucial tonsils had been removed about ten years ago. A submucous resection and antrum drainage improved the rhinological condition. In spite of

this the patient failed to show general improvement. Further examination showed that there were masses of hypertrophied lymphoid tissue on the lateral walls of the pharynx. These masses gave the appearance of a follicular inflammation. There was no rise in temperature, but definite systemic symptoms of a focal infection were present. One intensive electrocoagulation treatment was given to each mass at intervals of one week. The masses were not altogether destroyed, but greatly reduced in size and sterilized. Within two weeks the focal symptoms had disappeared. Gradually after that the patient improved in general health and added about ten pounds in weight. After one year the masses had not increased in size, nor had they shown evidence of reinfection.

R. E., male, age 42 years, single. At one time this patient had a bilateral antrum infection which produced an almost constant post-nasal discharge. Hawking and coughing were prominent symptoms. The tonsils had been removed in childhood, but there was some lymphoid remains in both tonsillar fossae. The posterior pillar on the right side was absent. The upper respiratory symptoms had been cleared up. On the lateral wall of the pharynx and extending almost into the right tonsillar fossa was a band of hypertrophied lymphoid tissue which resembled in appearance a true follicular tonsillitis. There were frequent acute exacerbations, which each time increased the enlargement of the lymphoid mass. Careful examination proved that this was not faucial tonsil remains. Three electrocoagulation treatments were given. The tissue was completely destroyed and the wall left smooth. There were no further symptoms, and examination of the pharynx, two years later, showed no evidence of macroscopic hypertrophy.

Comment: Hypertrophy of the lymphoid tissue of the posterior wall and lateral folds of the pharynx occasionally requires active treatment. When the hypertrophy is not marked, removal of the local cause, or elimination of the systemic factors, produces amelioration of the symptoms. In the more advanced cases, however, in addition to such other measures as may be indicated, reduction or destruction of the lymphoid masses is indicated. For either purpose the electrocoagulation puncture method is an improvement over the cautery electrode.

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BRONCHIAL OBSTRUCTION IN INFANCY.*

DR. D. M. LIERLE, Iowa City.

Some interesting studies have been made and considerable has been written regarding the diagnosis and treatment of bronchial obstruction in adults and older children. Clerf¹ has reviewed thoroughly the extensive studies made in this field up to the present time. Less has been written, however, concerning bronchial obstruction in infants and younger children. Two rather unusual cases observed in the infants' ward of the Children's Hospital during the last year prompted this report of bronchial obstruction in two patients less than 3 years of age. The similarity in the pathology found in their bronchi, the contrasting X-ray and physical findings, as well as the progress observed following bronchoscopic diagnosis and treatment seem worthy of further study.

Case 1: L. C., white male, age 11 months. On admission, the parents gave the following history: Six weeks ago the baby aspirated a portion of onion peel, became very cyanotic, and a "roaring in the chest" was noted. Since then he has had frequent spasms of coughing and his breath has been very foul.

Upon admission, physical examination and X-ray findings showed hilus infiltration bilateral, with considerable consolidation of the right middle and lower lobes, and some cross infection to the left lung. Also, there was definite shifting of the mediastinal contents to the right, with atelectasis of the right lung, particularly the middle lobe. (Tuberculin test was negative.)

Bronchoscopic examination revealed a tumor mass resembling granulation tissue, about the size of a small pea, attached to the anterior wall, just above the level of the opening of the right middle lobe bronchus. Here the tumor completely occluded the lumen of the right main bronchus. No obstruction was apparent in the left main bronchus. Adrenalin was applied to the tumor and considerable shrinkage resulted, permitting the aspiration of a large amount of foul pus below this area. This procedure was repeated at five-day intervals over the period of about three weeks. On the third bronchoscopic examination the tumor was discovered to be again quite large in size. Its removal was contemplated for the following week.

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but the fourth examination revealed that the tumor had disappeared completely and that the lung and mediastinal contents had resumed almost their normal position.

Case 2: J. A., Mexican boy, age 30 months. The history obtained showed that the present illness began six weeks ago with cough and fever. Three weeks ago the condition was diagnosed pneumonia. The boy has shown no improvement for one month.

On admission, physical examination and laboratory findings all pointed to a rather diffuse pneumonitis in both bases. Both hilus areas were markedly enlarged, with large peribronchial glands. (Tuberculin test was positive.) One month later, chest examination

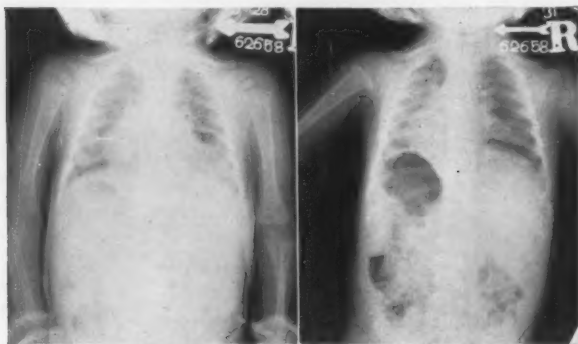


Fig. 1. (A) Roentgenogram of infant boy, age 11 months, showing atelectasis of middle and lower lobe of right lung, with displacement of heart to the right; (B) Roentgenogram of the same patient, taken after bronchoscopic treatment and aspiration. Lung is fairly clear and the heart has gone back to the left.

revealed very little movement, associated with decreased breath sounds and hyper-resonant percussion note on the right side.

X-rays taken at this time show a shift of the mediastinal contents to the left, with emphysema of the right lung. At bronchoscopic examination, the right main bronchus was found to be almost completely occluded with a tumor mass, resembling granulation tissue. It bled easily upon slight manipulation. Check-valve action was noted, air being inspired only. Adrenalin was applied to the tumor and surrounding swelling, and marked shrinkage was noted. A moderate amount of thick pus was aspirated from below the swelling. There was no obstruction in the left bronchus. X-rays and physical findings immediately after bronchoscopy showed marked return of the heart to the normal position.

Bronchoscopic treatments were continued at six-day intervals. The mass gradually became smaller and physical findings and X-rays showed improvement, until, at the end of six weeks there was practically complete return to normal position. This would seem to rule out hilus tuberculosis.

Aspiration of vegetable foreign bodies is fairly common among infants and younger children. Because of the resulting inflammatory reaction, Jackson² believes they are probably the most frequent causes of various types of bronchial obstruction, depending upon the location and degree of inflammation.

The lumen of the infant bronchus is small and very little inflammatory reaction of the mucosa is necessary to produce marked ob-

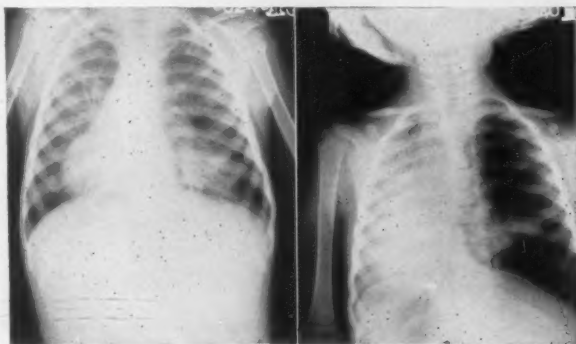


FIG. 2. (A) Roentgenogram of the chest of an infant, aged 30 months. On admission both hilus areas show rather marked enlargement. Both bases show a rather marked parenchymal infiltration; (B) Roentgenogram of the same chest just previous to bronchoscopy. Marked shifting of the heart to the left side, due to the marked emphysema of the right lung.

struction, although the foreign body may be negligible in size, or apparently absent at the time of examination. Sometimes one finds just swelling or granulation tumor reaction. Also, during early paroxysms of coughing, the small, vegetable offender may shift its position, resulting in varied physical and X-ray findings from time to time.

Our experience has revealed more surrounding parenchymatous involvement and occasionally more fever and leukoncytosis with a vegetable foreign body in an infant than is found in an older person. Thus, it may be very difficult or even impossible to determine whether the obstruction is due to inflammatory reaction of a primary chronic pneumonia, or bronchiectasis, as Tucker³ mentions, or the

result of a vegetable foreign body with secondary lung involvement. A very careful history may be helpful. Beyond doubt, atelectasis resulting from bronchial obstruction following primary lung pathology does occur frequently, and the second case reported supports this belief. However, the possible presence of a foreign body should not be overlooked, even though inflammatory reaction could account for physical findings. It is often extremely hard to determine the etiological factor.

Because of the inability of infants to tell of their experiences or to describe accurately their feelings, many patients are not seen until weeks or months following the aspiratory accidents. Finally, when chronic "coughs or pneumonia" do not clear up, the children are

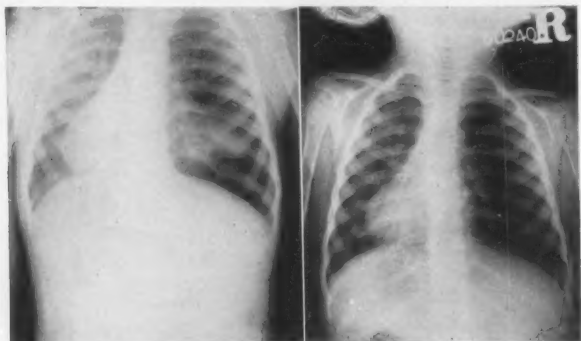


Fig. 3. (A) Roentgenogram of the same patient as in Fig. 2, showing a partial return of the heart to its normal position. This film was made immediately following bronchoscopic treatment. (B) Roentgenogram of the same patient, following the last bronchoscopy; the tumor has entirely disappeared, the lung is now clear, and the heart is in its normal position.

taken to the pediatrician. X-rays frequently reveal the first real clue to the causes of the trouble.

Atelectasis in young infants, the etiology of which is often never determined, is frequently the result of the aspiration of thick, tenacious secretion, associated with pulmonary disease, as Tucker³ has shown in studies of adults.

Next in importance is the possibility of pressure from without. Because of the very high incidence of the hilus type of tuberculosis in infancy, obstruction from pressure of the peribronchial glands always must be kept in mind, as Myerson⁴ so definitely has shown. A negative tuberculin reaction aids greatly in questionable cases. If the gland has eroded through the wall of the bronchus, a biopsy is helpful.

Benign neoplasms of the bronchi are extremely rare in infants. Patterson⁵ reports a total of only 26 cases of benign neoplasms of the bronchi in all of her observations. Most of these were in adults, the youngest being 6 years old. Other unusual conditions may be neoplasms outside the bronchus causing pressure obstruction, and congenital malformations.

CONCLUSIONS.

1. Infants and young children with stationary or progressive chronic pneumonia should have bronchoscopic examination, particularly when there is evidence of atelectasis or emphysema.

2. Continued infection, or foreign body in the bronchi, may cause reaction with swelling and accumulation of granulation tissue.

3. In infants and young children a very small tumor and surrounding inflammation may completely occlude a bronchus.

4. There is a tendency for these inflammatory masses to increase and decrease spontaneously in size.

5. Careful history and physical examinations should augment the bronchoscopic examinations to diagnose and remedy the condition accurately.

6. Pressure from tuberculous glands must always be kept in mind and ruled out whenever possible.

7. Neoplasms and congenital anomalies causing obstruction in infants' bronchi are rare.

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University Hospital.

SYNDROME OF CAVERNOUS SINUS THROMBOSIS DUE TO VENOUS CONGESTION OF THE RIGHT CEREBRAL HEMISPHERE.

DR. T. E. BEYER, Denver.

To the comprehensive literature pertaining to cavernous sinus thrombosis little or nothing of value can be added. The clinical and pathological studies of Eagleton¹, Germain², Chisolm and Watkins³, Braun⁴, Jackson⁵ and others beggar further serious discussion. Hence, it is not the purpose of this paper to review the voluminous literature and add just another case. The object is rather to put on record a case which clinically simulated cavernous thrombosis but which, postmortem, revealed pathology not heretofore referred to in the literature.

Case Report: Miss D. P., an American girl, age 21 years, was seen in consultation with Dr. Craney on Oct. 8, 1931.

Past History: Diabetes mellitus for the past three years. Insulin therapy at intervals.

Present History: Five days ago she had two lower right molars removed under local anesthesia and the right upper bicuspid which was abscessed treated by cleansing the root canal and killing the pulp. The two operations consumed nearly two-and-a-half hours. During the following 48 hours she took about 30 Anacin tablets. On the third day she suffered an attack of weakness and dyspnea at the dentist's office. She was returned to her home and given 40 units of insulin. Her attending physician pronounced her sugar free. The next day she became irrational and her relatives noticed some bulging of the right eye. On the following day I was requested to see her.

Examination: The patient was semiconscious. The right eye was markedly proptosed. There was extensive soft edema of eyelids and chemosis of the conjunctivae. The tissues over the right zygomatic and malar regions were swollen. Some movement of the eyeball in the lateral directions remained. The right pupil reacted very sluggishly to light. Examination of the eye grounds showed marked engorgement and increased tortuosity of the retinal vessels but no hemorrhages. The left eye was apparently normal. The nose showed slight obstruction on the right side due to a hypertrophy of the middle turbinate but there was no evidence of pus. Transillumination

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of the antra and frontals showed these to be clear. The oral cavity was unusually dry but otherwise negative. A blood clot filled the site of the operations on the lower molars. The right upper bicuspid tooth showed a large cavity. Examination of the ears, chest and abdomen was negative. There was no rigidity of the neck nor of the extremities. The knee-jerks were absent. The patient had a temperature of 102.5° , pulse 110, and normal respirations.

Diagnosis and Prognosis: In view of the history, the toxemia, the local edema and the orbital signs of venous stasis the diagnosis of cavernous sinus thrombosis was unhesitatingly made. The relatives were apprised of the serious nature of the patient's ailment and were given a grave prognosis. This proved to be correct for the patient gradually became comatose, and died within ten hours without any marked change of symptoms.

That the diagnosis of acute fulminating cavernous sinus thrombosis was justified seems beyond debate. There were obviously two possible routes of infection, one from the bicuspid tooth along the anterior ophthalmic route, the other from the site of the lower molars to the internal jugular and thence upward through the inferior petrosal. The rapid onset of orbital and ocular symptoms suggested that the infection probably extended along the shorter of the two routes, the anterior ophthalmic.

The fact that ocular symptoms were limited to the right side does not militate against the diagnosis of cavernous sinus thrombosis. In a fourth of Germain's series of 182 cases there was unilateral involvement only. Hegener⁶ goes so far as to say that in 25 per cent of the cases of cavernous sinus thrombosis eye symptoms are absent; and that, quoting Uhthoff, unilateral edema of the lids without exophthalmus is sufficient for the diagnosis.

Cranial nerve involvement with attendant paralytic phenomena occurs late in the disease and was not to be expected.

Orbital cellulitis or abscess was excluded by the absence of evident pathology in the accessory nasal sinuses and by the rapid onset and termination of the condition. Further arguments against such a diagnosis were the absence of pain and the mobility of the eyeball.

There remained the underlying diabetes which, in the absence of glycosuria appeared to be of little import. The patient's general appearance had none of the earmarks of ketosis. Air-hunger was noticeably absent. The temperature, tachycardia and restlessness, on the contrary, bespoke a profound toxemia rather than diabetic coma. Marasmic thrombosis may occur in diabetes but since this never primarily involves the cavernous sinus it was not seriously considered.

Acetanilid poisoning while admittedly a possible contributing cause of death could not account for the septicemia and ocular findings.

The diagnosis of cavernous sinus thrombosis as a complication of dental surgery then appeared to be well established.

Postmortem examination by Dr. Freshman revealed the following:

Postmortem Examination; External Examination: Body is that of a well developed white adult female. Body has been embalmed. Soft tissues about right orbit are swollen. There are no other external markings.

Internal Examination: Autopsy limited to head. Dura is firmly adherent to the calvarium. Superior longitudinal sinus patent along its course. Vessels of right cerebral hemisphere are markedly engorged. Left appear normal. No gross abnormalities could be demonstrated in brain. Venous sinuses at base of skull were found to be filled with blood. No antimortem clots were demonstrated. Right orbital cavity appears normal.

Anatomical Findings: a. Proptosis of right oculus. b. Venous congestion of right cerebral hemisphere. c. Congestion of venous sinuses.

Microscopic Examination: Section from cavernous sinus wall shows no evidence of phlebitis.

Cause of Death: Undetermined.

Comment: The case described presented all of the most constant and significant ocular and orbital symptoms of cavernous sinus thrombosis.

Postmortem examination failed to reveal the presence of such a thrombus but showed instead a congestion of the whole of the right cerebral hemisphere.

The conclusion is therefore warranted that the signs usually considered pathognomonic of cavernous sinus thrombosis are not necessarily proof positive that such a condition exists but that they may be due to other cerebral conditions, such as congestion of the cerebral hemisphere.

This leads to the further deduction that cases of spontaneous cures based on this clinical syndrome are not necessarily proven cases of cavernous sinus thrombosis.

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CASE REPORT: SEVERE NASAL HEMORRHAGE DUE TO INFRACTION OF MIDDLE TURBINATE.*

DR. SACKS BRICKER, Philadelphia.

Mrs. A. G., Jewish, age 45 years, married; has four children, all in good health. One died in the war. One son had an amputation of a leg and developed a secondary hemorrhage a few days after and almost died. She had a pelvic operation at University of Pennsylvania Hospital seven years ago. Tonsillectomy, June, 1931. No bleeding.

On Dec. 5, 1931, patient complained of left-sided parietal headache and on examination a diagnosis of left sphenothmoidal sinusitis was made. The left turbinate was jammed against the bulla ethmoidalis and as a first step in her treatment it was decided to infract her left middle turbinate. This was accompanied by a small amount of bleeding, which shortly subsided. On Dec. 8, four days later, the patient came to the office for treatment, at which time she was examined with a nasopharyngoscope. Under the shelving portion of the middle turbinate, about as far back as the maxillary ostium, a petechial spot about the size of a small pin head was observed. No bleeding had taken place since the time of operation. On the evening of the ninth patient complained of bleeding several times and claimed to have lost about a pint of blood. On the morning of the tenth she came to the office, but there was no evidence of a severe hemorrhage having taken place and after assuring the patient that nothing seriously wrong appeared in the nose, she left the office. About 6 o'clock I received a call from her family stating that she was having a severe hemorrhage. She was advised to immediately come to the office, and appeared in about a half-hour. I took her blood pressure to see if this was a possible etiological factor and found blood pressure of 164/70. While in my office she bled rather profusely and lost a quantity estimated at about a quart. A postnasal pack was placed in the nasal pharynx and the left nostril was packed anteriorly and bleeding was controlled.

On Dec. 11 she complained of blood oozing down her throat, and in consultation with Dr. Ridpath the anterior nasal pack was removed and a second one inserted. During the day she bled a little, and as

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a precautionary measure she was sent to the Jewish Hospital that evening. She seemed to be fairly comfortable during the night, but on the morning of the twelfth about 7 o'clock a severe hemorrhage occurred producing unconsciousness. She was vigorously stimulated with caffeine and sodium benzoate and intravenous salt solution and responded to the point where consciousness was regained. She was in such an exsanguinated condition that it was impossible to even move her from the middle of the bed to the edge for fear she would die. On the day before, a turbinectomy had been considered in order to pack against the bleeding point, but her condition was so precarious that it was thought best to leave well enough alone, with the hope that the hemorrhage on this day would be the last.

On the twelfth, it was surely out of the question and the only other available thing to do was to tie off her external carotid, which I did at a point above the sup. thyroid ar. under a local anesthesia. After the wound in her neck was sutured a blood transfusion of citrated blood was given and after about 125 c.c. had entered the vein, skin manifestations of impending anaphylactic shock appeared and the transfusion was immediately stopped. In a few minutes a severe shock took place, with severe pulmonary symptoms and unconsciousness. She was again revived by vigorous treatment and had a fairly hasty convalescence.

On Dec. 13: Hemoglobin, 53 per cent; 2,900,000 R. B. C. rt. after blood transfusion. On Dec. 16: Hemoglobin, 37 per cent; 2,300,000 R. B. C. rt. after blood transfusion. On Dec. 22: Hemoglobin, 48 per cent; 3,000,000 R. B. C.; On Dec. 28: Hemoglobin, 56 per cent; 2,900,000 R. B. C. About Jan. 20, 1932: Hemoglobin 62 per cent; 3,500,000 R. B. C.

X-ray taken while confined at the Jewish Hospital showed there was haziness in the right ethmoids, left antrum and both sphenoids.

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International Digest of Current Otolaryngology.

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An interesting report on absorption through the sinus mucosa appears in the editorial section of the *Jour. A. M. A.*, March 19, 1932. An investigation of the subject has been reported by Childrey and Essex, and they are of the opinion that absorption of drugs and certain therapeutic agents from the nasal sinus and nasal cavity either does not occur or exhibits a low degree of efficiency. This is in marked contrast to some of the typical absorbing membranes elsewhere in the body. This leads to the two-fold conclusion that highly toxic substances may be used in the treatment of sinus disease without fear of absorption and that absorption of toxic material from the sinuses (focus) is rather improbable.

Pilot and Davis, of Chicago, in the *Jour. A. M. A.*, Dec. 5, 1931, present an article on sporadic septic sore throat. They trace this condition either in the sporadic or epidemic occurrence directly to infected milk. The epidemic form occurs directly from the infected milk, while the sporadic may occur by infection from a human carrier of the disease. The clinical manifestations of this disease are more severe in nontonsillectomized patients than in those who have had their tonsils removed. The clinical picture in patients with tonsils is well known to everyone. In patients with no tonsils the picture may vary greatly; it usually resembles an influenza. Complications and sequelae are also more common in patients who have not had a tonsillectomy. The authors lay great stress on what they call the chronic stage of the disease in which the patient becomes the carrier. Tonsillectomy should be strongly advised in these cases as the organism is shown to persist in the tonsillar crypts.

Bacteriologically the disease is caused by a hemolytic streptococcus, which is often called the streptococcus epidemicus; complications are also due to this organism.

Carmody, of Denver, read a paper on "Treatment of Chronic Diseases of the Accessory Nasal Sinuses," before the Nineteenth Annual Meeting of the Pacific Coast Oto-Ophthalmological Society, May 29, 1931. The paper and the discussion appear in the *Transactions* of that Society. He presents the symptomatology and treatment of the more common conditions and discusses the results obtained in a long, extensive practice. The article is discussed by Mullin, of Cleveland; Wanamaker, of Seattle; Lewis and Jesburg, of Los Angeles; Jones, of Boise. The paper and the discussion make very interesting reading.

Cunningham, of the University of California, in the *Archives of Internal Medicine*, 47:513, 1931, reports a comprehensive statistical study on the results of tonsillectomy. She has studied 14,000 women students in the course of the past ten years. Previous histories of these various cases were carefully and accurately obtained. Some interesting observations were made by the author in relationship to the condition of the tonsils and infectious diseases of childhood; especial attention was given to cardiac conditions. The author found that evidence of damage to the mitral valve showed less among the group with normal tonsils than among those whose tonsils were absent or pathologic; in this respect, the latter two groups seemed to suffer equally. The tonsillectomized group showed about one-half the percentage of damage to the aortic valve that was shown by the group whose tonsils were thought to be normal or pathologic. The incidence of rheumatic involvement was about equal in the groups which had normal and pathologic tonsils, but was significantly higher between these two groups and those on whom tonsillectomy had been performed.

The group with absent tonsils had a history of higher incidence of an illness and operation than did either of the other two groups. A possible explanation for this is that the cases most frequently ill were those most frequently operated upon.

Tonsillectomy and age of tonsillectomy seemed to have no influence on the total incidence of measles, mumps, chickenpox, whooping cough, pneumonia and influenza; however, early tonsillectomy seemed to have a slightly favorable influence on the incidence of scarlet fever and diphtheria.

THE NEW YORK ACADEMY OF MEDICINE.

SECTION OF OTO-LARYNGOLOGY.

Meeting of Nov. 25, 1931.

Surgical Treatment of Facial Palsy; Ballance-Duel Method. Dr. Arthur B. Duel.

(Published in full in this issue.)

DISCUSSION.

DR. S. C. HARVEY: Fools rush in where angels fear to tread. I am no angel and will not be foolish enough to launch out on a sea which I don't know about. But we have a man here who does know, and I will start this tale and say the face is a mirror of the soul.

That means that this facial nerve that we are dealing with has much more to do than many motor nerves. If you repair the median or the ulnar nerve with an autograft—not too long, for the experiments depend somewhat on the length; but certainly nerves that are repaired where there is complete loss of function frequently regain it almost to perfection. This facial nerve when it is repaired in these animals regains, when repaired with a graft of 16 mm.,—12, 9, 6—almost perfect recovery; but of course these animals have not any such use of facial expressions as human beings, and therefore is brought up the question of how fine a result one may get by the repair of the facial nerve. The usual motions of the face, perhaps in laughter or surprise, may in a way be comparable to the motions of the faces of these animals; but when you think of producing a facial expression like that of the Madonna, there is just the difference between the expression on a face that shows the serenity of motherhood which would not be present in an animal. And the great question is whether or not the facial nerve has been repaired so that facial movements—as in the child—would be able to express its wants successfully and evenly. The expression on the face of the evangelist when he influences a score of people to walk the trail—I doubt if it would be possible to repair a face to express such a nuance.

DR. J. RAMSAY HUNT: It is a great pleasure to be present this evening and to take part in the discussion of this interesting subject. Dr. Duel and Sir Charles Ballance have been most thorough in their preliminary investigations on animals before attempting their operation on human beings, and it has been my privilege to see some of their experimental animals. Indeed, their clinical and surgical attitude toward the questions involved have been a model of conservatism. This combination: a general surgeon of distinction, whose name has long been associated with the development of neurological surgery, and an eminent otologist of rich experience, has been an ideal one and as the result of their labors we have a new operation procedure for the treatment of severe and intractable types of facial palsy.

You are all familiar with the earlier efforts in nerve anastomosis of the facial nerve. Sir Charles Ballance was one of the pioneers in this field and in this country. Elsberg, Cushing and Frazier were among the first to investigate this problem. First the spinal accessory nerve was used and later the hypoglossal, both presenting certain disadvantages.

The poor results obtained by these earlier methods were due in large part to the development of associated movements from the innervation field of the anastomosed nerve, viz., the spinal accessory or hypoglossal fields, as the case may be, and it was the keen realization of this cardinal defect which has been the great stimulus in bringing about a direct approach to the facial itself and the perfection of a new method of nerve grafting in the Fallopian canal which could eliminate the grotesque and very disfiguring associated movements of the face, with movements of the head and shoulder or the tongue in the hypoglossal cases.

The authors by experiments on baboons and monkeys were able to show that this direct operation was not only possible but yielded successful results, in that facial innervation was restored without the disfiguring associated movements, which had marred the results in other types of operative procedure.

Whether such an operation, being successful in the monkey, would also be completely successful in the human subject is open to question; nevertheless, the animal experiments were sufficiently numerous and convincing to warrant the effort to relieve severe and intractable cases by the direct nerve grafting method.

The cases selected for operation were all of the severe type, which amply justified the operation and, so far as one is able to judge at this postoperative stage, the results are distinctly encouraging.

In the little child the restoration of function is the most striking and, of course, this early age is in itself a very favorable factor. In the other cases it is as yet too soon to arrive at a definite conclusion. All one can say is that power and tonus are returning and time alone will determine the ultimate results, and the degree of voluntary and emotional control of the face obtained. It will be of especial interest to observe if there is the same tendency to over-action and tremors of the facial musculature as occurs after severe facial palsies of inflammatory origin, or whether these unpleasant sequelae are eliminated by the operation method under discussion.

An important question is the indication for the operation and in how large a number of cases it is applicable. In the ordinary inflammatory forms of facial paralysis, not due to wounds or operative lesion and where there is no solution of the continuity of the nerve, the paralysis may be of three types, depending upon the degree of injury of the nerve trunk. There are light, medium and severe degrees of palsy. Now, the lighter cases recover promptly in a few weeks and there are no residual signs of the previous palsy. This is not true of the medium grades of palsy, some slight after-effects of which usually persist through life or, at least, for many years, and are indicated by a little over-action of the affected side of the face, slight tremors or twitchings, and even associated movements, the commonest one being a little drawing of the mouth on closing the eyes.

In the severe type the above symptoms are all exaggerated and while there is retention of tonus and considerable return of power, the disharmony of function and lack of synchronous activity, with the other side, produces a marked deformity of expression. The associated movements, often very severe and disfiguring, occur when the lesion is confined to the facial nerve itself, and are different in character from the associated movements when another nerve distribution is tapped, e. g., the spinal accessory and hypoglossal.

It is an interesting question as to whether such associated movements would develop after the Ballance-Duel procedure of nerve grafting. I think it would certainly in adults. The situation may be different in infancy and childhood when facial expression has not yet matured and is largely reflex and emotional in nature.

For, if severe residuals occur after inflammatory lesions of the nerve trunk, when there has been no wound or division of the nerve, I can see no reason why after the complete division of the nerve trunk, as would occur in nerve grafting, there would not be a similar development of residuals. For, while the nerve trunk is in good apposition and meets perfectly, there must be of necessity some scar formation and some central fibres which formerly were destined for the upper face become connected with fibres destined for the lower face, and vice versa.

It may be that the functional results will be better than might be anticipated and that the operation may have a wider application than I believe at present, but these are all questions for the future and can only be determined by further observations and experiences.

Dr. Duel has referred to a theory of mine on the "Existence of Two Distinct Physiological Systems for the Transmission of Motor Impulses in Peripheral Nerves," and its bearing on some of these questions under discussion, especially the restoration of functional activity after paralysis. According to this theory there are in peripheral nerves two systems, a paleokinetic and a

neokinetic, corresponding to similar divisions of motility in the central nervous system. In the brain and cord, the pyramidal tracts subserve a neokinetic and the extrapyramidal tracts a paleokinetic function. The neokinetic system is concerned with the isolated-synergic types of movement, while the paleokinetic controls movements of the automatic-associated type.

In the face the emotional movements are of automatic-associated type, although isolated movements are demonstrable, such as closure of one eye, retraction of one angle of the mouth, elevation of the brow. Of course, in ordinary facial activity both types are combined and harmoniously blended, but after injury of the nerve the automatic-associated movements are the first to recover and in severe cases isolation of movement may never recover. The reason for this, I believe, is that the neurones of the neokinetic system are more highly specialized and more vulnerable and do not regenerate so readily as do those of the paleokinetic system.

There is another factor which must also be considered. After suture of a nerve, it is of course impossible to bring into apposition corresponding nerve fibres, so that the central end of the nerve formerly controlling the upper face may become united with nerve fibres controlling the lower face. This, by some, is thought to explain the persistence of associated movements after severe types of facial palsy, when closure of the eye is associated with contractural movements of the angle of the mouth or of the brow on the affected side. There is also the tendency to tremors and over-action of the face, after severe cases, which has been supposed by some to be associated with an over-excitability of the facial nucleus on the affected side. These are some of the difficulties which have to be overcome in the relief of facial palsy and only further study with this new method will reveal its true value.

Great care must be used in transferring to human beings the data obtained from operation on monkeys, and this Dr. Duel has emphasized in his paper. The variety and nuances of facial movement and expression are of the greatest delicacy in the human being and it is very doubtful if after complete division of the nerve a perfect functional recovery is ever possible.

The operation which has been described, of a direct approach to the facial nerve itself in the Fallopian canal, represents, in my judgment, a real step forward and the authors are to be congratulated on their skill and perseverance in working out this very difficult procedure—certainly not one to be attempted by any novice and only by the experienced otological and neurological surgeon after very special study.

DR. CHARLES A. ELSBERG: When an individual has had an injury to a peripheral nerve, the sciatic or ulnar, for example, his main trouble is due to loss of function, and he comes to the surgeon to receive treatment and to regain the function that has been lost. When an individual has had an injury to the facial nerve, there is an added and very important factor, namely, the deformity which often makes of the patient more or less a recluse. Therefore, any new effort to relieve facial palsy by operative means must be welcomed, and the description of any new procedure listened to with great interest. Knowing the great ingenuity and enthusiasm of Sir Charles Ballance and the energy of Dr. Duel, it is not surprising that they should have devoted so much study to this problem, which is not only of importance but is one that has never been satisfactorily solved. The few remarks I shall make will have reference to injuries of the facial nerve, whether produced by accidental wounds, at operation, or in other ways.

In approaching the subject one must understand what happens when there is an injury to a peripheral nerve. There is in the peripheral fragment a so-called Wallerian degeneration. When the two ends of the divided nerves are sutured together, the nerve fibres from the central end must grow down through the peripheral part of the nerve to the finest terminations in the muscles or other soft tissues. If the ends of the divided nerve cannot be approximated by suture, then either a nerve transplant or some type of nerve anastomosis is necessary. As Dr. Duel has said, great delicacy of manipulation and a highly developed technique is necessary for all of these operations.

The transplant or graft offers a good channel along which the nerve fibres can grow down through it into the peripheral end of the divided nerve. Good

regeneration is greatly favored if the area of operation lies in a smooth cavity, so that the new axones can travel downward along a preformed canal. It is therefore useful to surround the graft and the line of union with some kind of material which will form a smooth channel, such as, for example, Cargile membrane or rubber tissue.

The facial nerve in its canal is under ideal conditions for the regenerative process. There is a perfect preformed canal through which the new axones or fibrils can grow from the central to the peripheral part of the divided nerve, and in this bony canal, the conditions are ideal for the autotransplant. Under these very favorable conditions, the nerve graft may be very successful, and herein lies the value of the operative procedure devised by Ballance and Duel, and described this evening.

As far as other peripheral nerves are concerned, there have been some successful results after the use of transplants, and there have been many failures. A large experience with nerve grafts was gained in the great war but, as far as we know, there was only a moderate percentage of good results. The most perfect recovery has been obtained by the use of autografts. Such an autograft undergoes the same Wallerian degeneration as does the peripheral fragment of a nerve below the point of division with the characteristic changes in the myelin sheath, and with the same changes also in the cells of Schwann, which are supposed to be important structures in the process of regeneration.

The early return of tone in the muscles which was mentioned this evening is of considerable interest. Occasionally, after an operation upon a peripheral nerve, one sees a remarkable return of tone in the muscles supplied by the nerve within 24 to 48 hours after the operation. Some years ago a case was published by Cushing in which, within 24 hours after the suture of a divided facial nerve, there was a definite return of movement of some of the muscles of the face. I have seen a return of tone in the muscles supplied by a divided peripheral nerve within a short time of the operation and, like many others, have not been able to give an adequate explanation for this occurrence.

I can testify that facial-spinal accessory and facial-hyperglossal-anastomoses do not always give satisfactory results. The associated movements of the shoulder or of the tongue, or the secondary atrophy of the tongue, may be very disturbing to the patient.

The operation proposed by Ballance and Duel with a perfect canal along which the new fibres can grow is a promising method. Without doubt, the younger the individual and the earlier the operation after the injury, the better are the chances for a good result. I do not know whether the readers of the paper have made any experiments in which they divided the facial nerve and then took a number of months before they sutured the divided ends or interposed an autograft. Therefore, if I might so suggest, a series of experiments should be made in which the injury is produced, a number of months allowed to elapse before an operation is done, and the results then studied. The conclusions arrived at after such experiments done according to the Ballance-Duel method will surely be very interesting.

I have been greatly interested and instructed by the presentation by Dr. Duel. The method proposed is a promising one, especially for those patients who have a facial paralysis following an ear disease or mastoid operation. I wish something could be done for another class of patients—those with facial paralysis due to a tumor of the acoustic nerve. It happens at times that after the tumor has been satisfactorily removed, the facial paralysis will persist. I have recently operated upon a patient who had a large acoustic nerve tumor in which a very complete intracapsular enucleation was done. Since the operation the patient has been talking to me continually about her facial paralysis, and has said very little regarding the removal of the intracranial tumor. In cases of this kind, where the lesion of the nerve is near the pons, a nerve graft would, of course, not be indicated, and all that can be done is a nerve anastomosis or some type of muscle plastic, to diminish the facial deformity.

Finally, I may repeat that for division of the facial nerve in the facial canal, the operation proposed by Ballance and Duel and so thoroughly worked out in the large number of experiments upon animals is very promising.

DR. S. C. HARVEY: I was not expecting to be called upon to discuss this paper but rather came to learn something about the restoration of the facial nerve, and I have learned a great deal.

I am impressed, of course, as I have been many times before, with the great eccentricity of this nerve, so that I think one has to approach this problem with a great deal of circumspection. It seems to me that this contribution made by Dr. Duel and Sir Charles Ballance is very promising. As brought out by Dr. Elsberg, the fact that attempts are being made to anastomose the nerve in its own continuity and without bringing in other nerves is highly important. If that can be accomplished, it certainly is a great advance.

Perhaps one warning ought to be uttered. I saw this attempted in 1913 and a semicircular canal was opened. That is not liable to happen in the hands of a skillful otologist, but may in those of an unskilled otologist or a general surgeon who is not familiar with the finer details of the temporal bone.

I am very glad to have heard this excellent contribution and it may well offer the best solution in instances of facial paralysis due to trauma.

DR. JOHN R. PAGE: I would like to ask Dr. Duel what he considers the indications are for decompressing the nerve when there is no break in its continuity. When is decompression indicated?

DR. DUEL: Dr. Page has asked, "What are the indications for decompression?" The answer to this, in a sense, opens up an unexplored field and therefore leads us into a somewhat theoretical consideration of the matter.

I have shown you the moving pictures of a young woman about 20 years of age, who exhibits the results of "Nature's cure" of a Bell's palsy (a so-called refrigeration case) on the left side, 10 years ago. There has been a doubtful gradual improvement over a period of years; but there still remains such paresis that the deformity is very marked, as you were able to see. Eight months ago there suddenly occurred a Bell's palsy on the right side. The usual reaction of degeneration took place, followed, as on the other side, by a partial recovery of facial movements. This, in a way, improved her appearance since it made the two sides more nearly equal. As you have seen in the pictures, however, the double paralysis with only partial recovery has resulted in a peculiar solemn look, in repose; and a shrinking, shy effort at all facial expression because she is so well aware of the peculiar appearance.

Now while we had her under observation, and treatment by occasional Galvanic massages of her muscles, she came about a month ago with another sudden complete palsy of the left side, the site, as you will remember, of her first attack 10 years ago. This was accompanied by pain, which so often occurs when the geniculate ganglion is involved. There was no herpes oticus. It is interesting to note that for 48 hours she showed, in this side completely palsied again, an increased irritation to Faradic stimulation. The muscles responded more violently to a mild current than they had ever done previously. In about two days, however, and ever since, there has been a complete reaction of degeneration, viz., no response to Faradic stimulation; a weak response in the muscles to the Galvanic positive closure; a little stronger response to Galvanic negative closure.

I have brought her here and, at the risk of wearying you after such a long evening, will show her to you. You will observe that she now has a complete palsy of the left side and a partial palsy of the right, in contrast to the pictures I showed you, where she had a partial palsy of both sides resulting in slow stiff movements, although nearly symmetrical.

Now this young woman illustrates admirably the points I wish to make in the theoretical discussion of Dr. Page's inquiry. In these so-called refrigeration cases of Bell's palsy, whether from temperature or toxic disturbances, there is an inflammation of the nerve tracts. One of the manifestations of inflammation is swelling. Now, if there is a toxic, or septic, or traumatic inflammation of a sensory nerve it manifests itself by pain (the business of the nerve) as a result of pressure. I take it that when there is a similar swelling in a motor nerve it manifests itself in a paresis, or complete palsy, of the muscles supplied by that nerve. The amount of loss of function will depend upon the amount of squeeze, and how long continued. The rapidity of the return of function, and

the amount of function eventually attained, will depend on how early after compression (from either trauma or toxic poisoning) it is decompressed.

Now this principle will apply to any nerve, anywhere. In the facial nerve we are dealing with a bundle of nerve tracts enclosed, not only in a fibrous sheath, but, as you know, surrounded also by a tube of bone as hard as ivory.

Compression within this tube from trauma or toxic infection is liable to extend along the whole length of the tube. If this is continued over a long period, the complete return of function of the muscles *cannot* take place while it is present, and *may not* after it is removed. It seems, therefore, if we are going to make the effort to obtain a return of function by decompression without replacement of the nerve; that the earlier the operation, the better the chance of success. To be more specific: In an operated case with accidental injury and complete palsy, I would operate at once. If there were a mere injury without division or removal of a part of the nerve, a decompression—by removal of bony wall and slitting of the fibrous sheath well above and below the injury—will insure recovery. If there is an actual break in the continuity of the nerve, the dehiscence must be replaced by an autoplasmic graft from the nerve of Bell or an intercostal nerve.

In the case of a Bell's palsy, with no apparent return of function after six weeks, or only a partial return with apparent cessation of improvement, or where there was no continued rapid improvement, I would decompress by the removal of the outer bony wall and slitting the fibrous sheath. This would give the compressed nerve a chance to expand and the squeezed nerve fibres a chance to regenerate. While this is theoretical, it is born of the experience on animals, that decompression of operated (grafted) nerves favors rapid recovery. The deduction seems sound.

I know that Sir Charles, if he were here, would say, "He who hesitates is lost." "Do it now." "The mill will never grind with the water that has passed." I am only reiterating what I learned from him through long and intimate discussions of the subject. I pass it on to you as the wisdom of the greatest surgeon I ever knew, a veritable wizard in what he has accomplished in neurological surgery.

If this young woman will consent to it, I think I shall decompress her facial nerves on both sides; and if I do, I shall be glad to show the result to you a few months later.

THE NEW YORK ACADEMY OF MEDICINE.

SECTION OF OTO-LARYNGOLOGY.

Meeting of Dec. 23, 1931.

End-Results in Sinus Surgery. Dr. E. Ross Faulkner.

(Appears in this issue of THE LARYNGOSCOPE.)

DISCUSSION.

DR. ROBERT BUCKLEY: I am very much impressed with Dr. Faulkner's comprehensive paper on this very formidable subject, and I feel that the thanks of the entire Section should be extended to him for the way he presented this very difficult, yet interesting topic. The end-results of sinus surgery cover such a variable and difficult field that I shall limit my discussion entirely to the end-results as considered locally. In other words, I shall not consider the complications or sequelae in any other part of the body. Unfortunately, the mere mention of surgery on the sinuses seems to produce a profound phobia, which I believe to be unwarranted, and which undoubtedly works for the detriment of the patient. The general physician, in introducing a patient, will so frequently remark that the suggestion of any sinus surgery will not be welcome by the patient, or by him the physician. This is most unfortunate, as it produces a prejudice against sinus surgery even before the patient is seen. I believe this phobia should be discouraged, as I feel that there is a very definite place for sinus surgery, and I agree with Dr. Faulkner that sinus surgery, when well done, and in well selected cases, gives excellent results.

The technical side of this paper has been so well presented that little is left to be said, except that I am sure we all agree. Dr. Faulkner's opening general statement, that the end-results locally depend entirely on how thoroughly the surgery is done, was very well taken. Incomplete sinus surgery, on any one of the sinuses, is practically always unsatisfactory. Undoubtedly the most frequent example of this is in the commonly done antrotomy. The inability to get the desired result is usually because the opening lasts too short a time, or, in other words, that the operation has been incompletely done. I was interested in what Dr. Faulkner said about the removal of a portion of the inferior turbinate bone. In most instances I feel we are too prone to ignore the inferior turbinate after antrotomy. We should always remember that when doing an antrotomy, the inferior turbinate bone is very small from medicinal applications, such as adrenalin, and may appear to leave excellent drainage, which, however, will be disappointing at a later date, when this same turbinate bone has assumed normal size and has come back into normal position. At this latter stage it will frequently completely block drainage from what would have otherwise been an excellent end-result. Dr. Faulkner's suggestion that the anterior part of the bone be left intact, I think, is an excellent one. I feel that in a large percentage of cases a good antrotomy will suffice, and that the Caldwell-Luc operation is being performed less and less as time goes on. I state this with considerable pleasure, as I feel that in the past this operation has been much overdone. This seems true because the operation is always attended with considerable shock to the patient, both at time of operation and afterward, the latter chiefly showing itself as a partial loss of sensation over the cheek, which the patient will so frequently interpret as pain, and which in some cases may even last for months. Consequently, today I believe many of our laryngologists are doing relatively less Caldwell-Luc operations and more wide surgical antrotomies.

Coming to the ethmoid and sphenoids, Dr. Faulkner has well said here is the cause of most of the lamentation in sinus surgery. There is no question that incomplete ethmoid and sphenoid operations are unsatisfactory and, unfortunately, the ethmoid is too frequently incompletely operated on. Furthermore,

the ethmoidal sinus, I think, is the real origin for the phobia above mentioned, since surgery on the ethmoidal sinus is bound to be attended with some danger, particularly by the unskilled operator. I feel that surgery on this sinus is far more difficult than surgery on the sphenoid, as the bony structure of the sphenoid is far more solid when set in its normal position, in the body of the sphenoid bone. The upper boundaries of the ethmoid, however, are usually comparatively thin, so that dura can more easily be injured than in the case of the sphenoid. The perforation of the dura, with resulting tragedy, is usually caused by the operator seeking a sphenoid too high up in the nose, thus perforating the cranial plate of the ethmoid over the middle or posterior ethmoidal cells. I should judge that the average very inexperienced operator, such as a partially trained interne, would make an error of approximately one-half-inch in looking for the sphenoidal opening.

Insofar as the external operations are concerned, the results are again dependent upon the thoroughness of the operation. The most surgical procedure is undoubtedly the operation of complete obliteration, but I am inclined to believe that the cosmetic result will more frequently influence the patient as to what technique shall be followed, so that today in most cases the patient will choose some less scarring modification, such as the Lynch operation.

In conclusion, I feel that Dr. Faulkner should be very highly commended for his very complete and extremely practical paper.

Sinusitis in Arthritis. Dr. R. S. Snyder, Dr. S. Fineman and Dr. Cornelius Traeger.

(To be published in a subsequent issue of THE LARYNGOSCOPE.)

DISCUSSION.

DR. LEE M. HURD: I think Dr. Snyder has presented enough cases and Dr. Fineman's clear records show that many cases of arthritis are due to infection in the nasal sinuses. The majority of these cases have a very mild involvement, that Dr. Fineman has termed latent.

I have tabulated 10 consecutive cases, as follows: Fifty per cent, or five, had previously had tonsil operations which effected no improvement in the arthritis. Three had previously had sinus operations. Three had had purulent discharge. One had had frequent colds. Four had had colds rarely. Three never had had colds. One had had headaches. One had had all sorts of operations: tonsils, submucous, three radical antrums and ethmoids, and the trouble was found in the sphenoid.

The sinuses affected were: Three ethmoids, one sphenoid, four antrums, two ethmoids and antrums combined.

Of the 10 cases, two had radical antrum operations, and the others were operated intranasally.

The results you have seen; nine were brilliant; one showed no improvement. The one from Connecticut was a remarkable result. She had what would be overlooked as a mild change in the ethmoid cells—very mild. She had been on crutches for 10 years, and shortly after this treatment she went without crutches and had only a slight limitation of the knee joint. That was her result from being almost a total invalid. The series consisted of nine females and one male; the ages ranged from 30 to 77 years.

QUERY: I would like to ask about the type of arthritis in the last—whether they were in the ethmoids or sphenoids, or were polypoid changes.

DR. BLAKE F. DONALDSON: I have been much interested in these papers of Dr. Faulkner and Dr. Fineman. Dr. Faulkner mentioned the prevalent skepticism concerning the end-results of sinus surgery. Before attempting to relieve a patient with arthritis by eliminating a focus of infection in a sinus, it is necessary to determine whether the arthritis falls into one of two main groups, either the infectious or the degenerative type.

Degenerative arthritis is apparently a disorder of circulation, of an inherited type. Where the rate of blood flow is slowest and the body temperature lowest, we see the process starting up, so that the big toe joints, fingers, ankles, knees and spine become involved in about that order. It is most commonly seen

in fat women after the menopause, so that it has gained the name of menopause arthritis. But it can occur in anyone with an inherited tendency, after the age of 32 years, when metabolism normally takes its first sharp drop. It is best explained to patients as a condition similar to bunions. In incidence, it far outnumbers infectious arthritis, which usually presents characteristic spindle-shaped enlargements of the joints. Degenerative arthritis, for some unknown cause, is prone to remissions. Where people are overweight, it seems to be made worse by high carbohydrate diets. It is the condition above all others that has brought the removal of foci of infection in the head into disrepute. It is, of course, unreasonable to expect improvement after the removal of infected teeth or tonsils, or the drainage of a sinus.

In true infectious arthritis it seems well to keep in mind the ability of virulent bacteria once they gain entrance to live around the joints where the temperature in the body is lowest. In No. 1 Hospital in Paris during the war several cases of ununited fractures were opened up six months after their compounded wounds had been closed and free from swelling, redness and elevation of temperature. In six of the cases, Gram stain of bone marrow at the time of operation shows Gram positive diplococci. Within six hours patients were running evening temperatures of 106° and hemolytic streptococcus pus was pouring from the wounds. More than anything else, these six cases resulted in the order forbidding operation for ununited fractures under nine months after the wound was closed. It seems that if a relatively high-grade organism like a hemolytic streptococcus could live for months without giving evidence of local irritation, that the less virulent organisms causing infectious arthritis can probably live for many years in the body. It has been my experience to only see two cases ever obtain immediate relief of their joint condition, following the elimination of a focus of infection in the head. It is probable that these cases were irritated by an exogenous toxin rather than by bacteria. Patients should be warned that removal of foci of infection usually results only in the arresting of further infection from that area. Joint lesions demonstrable by X-ray usually fall into the group of degenerative arthritis and are commonly apparently unaided by removal of foci of infection.

As to the point about the minute dose of vaccine used, I had the pleasure of personally looking over some of Dr. Small's charts in Philadelphia, on his use of streptococcus-cardio arthritidis vaccine. Dr. Small assured me that some of the terrific reactions recorded were obtained by the administration of what was about the equivalent of the juice of one-half of one streptococcus. As the work in tuberculosis has recently shown, these are probably allergic reactions, rather than evidence of an immunizing process.

Treatment of degenerative arthritis is quite successful if one insists that the patient actively exercise every affected joint and get body weight normal. It is possible to find an antrum that is quite opaque in an X-ray picture go back to a normal condition in 24 hours as angioneurotic edema passes off.

No one has mentioned allergy as the basic cause of sinus infection. Whether it is or not is problematical. The following points in family or personal history suggest an associated hypersensitive state: bilious attacks in childhood followed by headaches in later years, eczema, urticaria, acne, idiopathic leukorrhea, susceptibility to head colds, hay fever, bronchial asthma, food or drug idiosyncrasies, gastrointestinal irritability (this last, often mis-called colitis), dysuria where no infection can be demonstrated, and canker sores, all seem to follow the laws laid down by Mendel in regards to inheritance. The irritants which precipitate attacks of hay fever and bronchial asthma can often be determined by definite skin reagins. But in other allergic disorders these reagins may be absent and skin testing unimportant. It is my personal feeling that almost every case of sinusitis can be found to have other allergic manifestations, and that these patients rarely are permanently cured unless the underlying condition is attacked.

I have tried in the office to treat allergy by a good routine, getting the patient's normal weight, insisting on daily outdoor exercise and that they be reasonably free from social, physical and mental stress. I still feel that this is a factor of very great importance in correcting the condition. But there is a group which will not be benefited by such methods. In these cases if, after

thorough treatment of any suppurating process in the head by a competent nose and throat man, infection continues, it seems desirable to attempt desensitization artificially. Local irritation in vaccine therapy is probably a good index of its efficacy in immunization. We have given to 400 cases 8,271 injections of foreign protein in the form of boiled, skimmed milk. The injections usually number 24 and are given three times a week intramuscularly, starting with one-four c.c. and usually going a little higher than 2 c.c. In this number there have been 12 general reactions, all of which required relief with small doses of adrenalin. It is our belief that about 70 per cent of the patients with allergic disorders have been relieved for at least a year of some of their complaints. It seems quite impossible to tell whether bronchial asthma, canker sores, headaches, hives, recurrent attacks of sinusitis, susceptibility to head colds, bilious attacks, eczema, hay fever or acne will be affected. I have not seen any case where all the evident manifestations of allergy have been improved. Headache responds better than anything else to this therapy. My impression is that not more than 25 per cent of sinusitis cases are improved. These are, of course, sinusitis cases that have failed to maintain improvement on good surgery. However, some of the results on patients, who in the past have been subjected to what are now called nasal hysterectomies, are remarkable.

But this attempt at desensitization leaves much to be desired. Lessened susceptibility to common colds is noted in about 40 per cent of cases. I wonder whether we do not condemn the common cold too much? It may be valuable to us in our race with the microbes. A hard cold two or three times a year might be a protection against pneumonia.

DR. L. T. LEWALD: Roentgenologists are all interested in this subject from many points of view. I am particularly interested in knowing something more about the X-ray findings in the joint lesions, and would like to know if different types of arthritis were present, and whether the remarkable clinical improvement was demonstrable Roentgenologically after treatment.

DR. W. W. CARTER: Very little has been said about the ciliary epithelium. My view has always been that a sinus is as healthy as its cilia, and I do not believe that these are reproduced after once being destroyed. I do not think a sinus will ever become normal unless it has its ciliary epithelium; therefore, in all operations upon the sinuses an effort should be made to preserve as much of the lining mucous membrane as possible, for it may be that many of the cilia have not been destroyed by the disease, and these may resume their function following the advantages of free drainage afforded by the operation.

THE NEW YORK ACADEMY OF MEDICINE.

SECTION OF OTO-LARYNGOLOGY.

Meeting of Jan. 20, 1932.

Address by Charles J. Imperatori on taking office of Chairman of the Section of Oto-Laryngology of the New York Academy of Medicine.

Within the past fifty years the practice of oto-laryngology has developed so rapidly that it has become one of the major branches of medicine.

In Edward Meyer's "Geschichte des Alten Aegyptens," Vol. II, page 95, and translated from the Papyrus Ebers, he notes an inscription taken from a slab of the fifth dynasty that this monument was erected to Sekhet'enanch, a physician to King Sahura, for "having been kind to his nostrils."

Specialization in medicine is of ancient record. Herodotus in describing Egyptian medicine makes a very positive statement. Each physician treats a single disease and no more, thus the country swarms with practitioners, some undertaking to cure diseases of the eye, others again of the teeth, etc.

Fortunately, in some countries of the ancient world specialists were required thrice to essay their skill upon a slave or lower caste of man before operating upon their betters.

The disgusting drugs and fantastic practices mixed with cabalistic use of figures and signs have long lingered in medicine.

Pliny in his Natural History believed that he would be able to include all the wisdom of the world in these histories. He said, "I find that a cold is checked if anyone will kiss the nostrils of a mule." He puts it very delicately, for one is inclined to feel that he means the father of the mule. "Inflammation of the fauces and the pain will be cured by the dung of kids before they have tasted grass, if it is dried in the shade."

Undoubtedly, the precursor of the nostrums of the last century, possibly, the advertised cure-alls of our fathers' times and the advertised silver salts and various polychrome sprays of our own times.

Otology is as old a specialty and while the eardrums were but rarely seen in life, the anatomy was described. The physiology was but poorly understood and it is only in recent times that the physiology of the semicircular canals and cochlea has been described.

The ancients and even the moderns knew that the pouring of molten lead in the ears was fatal.

Frequently this was a favorite method of a king who presented to one in disfavor his visa to the Land of Shades, in the form of hot lead through the external auditory canal route.

But it was the King of Denmark whose mastoid operation stimulated further studies in the field of mastoid surgery.

Rhinology is even a more ancient branch of medicine.

It was during the middle ages that the exclamation of God bless you! following a sneeze evoked the power of Deity to protect one from the Black Death. It was recognized that sneezing was one of the precursors of the dreaded pandemic then sweeping over England and the continent.

The sternutatories that were given and the various apparatus for the removal of polypi, etc., are of great interest. Some of these methods have been in use until recent times. The nose was considered to be the beginning of the respiratory tract, for it was Moses, in Genesis II, 7, who said that, "And the Lord formed man of the dust of the ground and breathed into his nostrils the breath of life and man became a living soul."

Laryngology is an extremely modern science and dates from the discovery of the laryngeal mirror by Garcia and the further development of it by Czermak and Turck.

The international dispute surrounding the diagnosis of the final illness, cancer of the larynx, of the second Emperor of Germany, Frederick Wilhelm, and

the bitter and acrimonious assertions and recriminations, has made it a cause celebre. For the whole matter revolved around the location from where the biopsy was taken and the interpretation of the tissue by the renowned pathologist, Virchow.

Of course, long before pathological conditions were seen in the larynx, obstruction was recognized and tracheotomy performed. This was an operation described by many, but practiced by few. Brasavola, 1546, was probably the first who performed this operation in the modern way.

Fabricius eloquently praises the operation of opening the aspera arteria. "Of all the surgical operations which are performed on man for the preservation of his life by the physician, I have always judged to be the foremost, that by which man is recalled from a quick death to a sudden repossession of life, a feat which raises the surgeon nearest to the level of Æsculapius; that operation is the opening of the aspera arteria, by which patients, from a condition of almost suffocating obstruction to respiration suddenly regain consciousness, and draw again into their heart and lungs that vital ether, the air, so necessary to life, and again resume an existence which has been all but annihilated."

Although Paulus Aegineta quotes from the lost works of Antyllus, 117, who gives the first specific description of the technique of the operation of tracheotomy, it was but rarely practiced, and then a transverse slit was made either below the thyroid or cricoid cartilage.

We must not forget that Hippocrates in his treatises mentions the studies made by the Greeks of breathing, swallowing, vocalization and articulation. "It gives us pause to think that the life of Hippocrates overlapped that of Phidas and Praxiteles, of Anaxagoras, Socrates and Democritus, of Herodotus, Thucydides and Xenophon, of Plato, Aristotle and Demosthenes.

"We are filled with admiration for the mental activity of the nascent Greek civilization."

And so, including that galaxy of medical doers and teachers of the past and of our own times, we salute them and thank them for the wonderful heritage that is ours; to improve and amplify and to push on to new ideas and to the study of some of the problems that confront us.

First, as regards specialization and the repeated rappings, possibly yappings of college presidents and presidents-elect. They have characterized men of high ideals and deeds as "partialists" simply because, as in other professions, there are a few, and mainly because of economical and environmental conditions, who fail to live up to these ideals that have been so universally inculcated in medical men. Who gives more freely of his specialized training to those who cannot receive from the overbalanced and overlauded old family physician, than just these so-called "partialists" and with what wonderful relief from pain, return of function and even a further lease on life itself? Ask the patient.

What physician does not mix his specialism with emotional and psychic factors and without commercialism? If he does not, then he descends to the character of the professor of oto-laryngology depicted by Sinclair Lewis in his book, entitled "Arrowsmith."

Please do not forget that it was the practicing oto-laryngologists, preceded but by a few years, by the ophthalmologists, whose efforts were directed toward better specialism, by proper examination of candidates and by suggestion to the medical schools, both undergraduate and postgraduate.

Are we sure that every tonsil that is surgically removed should be? Are there other methods that shall prevail?

Kaiser's studies, and more recently Cunningham at the University of California has studied the results of 14,000 physical examinations in women under 35 years of age. She showed that evidence of damage to the mitral valve was less among those with normal tonsils than among those students whose tonsils were absent or pathologic. There seems to be a growing tendency to question the value of tonsillectomy as a prophylactic measure against infectious diseases and as a cure for rheumatism, chorea and carditis.

Is the radical surgery on the nasal accessory sinuses, with the consequent complete destruction of the ciliated epithelium, justified?

Excepting in but very unusually advanced diseased conditions and excluding malignant diseases and tumors, can't we give our patient as much relief with as much permanency toward a cure, by conservative methods?

How much do we know about the common cold, other than the report of the most recent scientific investigation, that it is produced by a filtrable virus?

Are we sure that with all our treatments and injections, etc., our patient would have been better, recovered more quickly, had we left them entirely alone, excepting for rest and proper dieting and nursing? The old adage that a treated cold will be cured in ten days, while an untreated one gets better in three days, may have some virtue.

And this almost always fatal malady that we have but recently become acquainted with—agranulocytosis and bone marrow failure. Is it due to inhalation of the gasoline-contaminated air of our city streets? Is it induced by X-rays or radium or arsenobenzol, or are we dealing entirely with a phase of aplastic anemia or of lymphatic leukemia, or is the etiological factor an ultra-microscopic streptococcus?

Of the cause and prevention of cancer, we know practically nothing. Of the treatment until the "open sesame" of the discovery is announced and "we shall see," early surgical measures must be continued and our technique improved. I speak particularly of cancerous lesions of the sinuses, tongue, tonsil, pharynx and larynx.

We do know that in the use of high voltage X-rays or radium on tumors of nondifferentiated cell structures that their control appears to be better than in the differentiated type. Tongue, tonsillar and occasional laryngeal tumors apparently yield to the effect by the ray. But at what expense of the other cells of the adjacent structures and, of course, the cutaneous tissues? Consideration must be given to further investigation to prevent deafness and restore hearing.

There are three thoughts that I wish to leave with you, and these are particularly directed to our younger group: 1. Understand and study more the physiology and anatomy of oto-laryngology. 2. Differentiate. Dr. Jonathan Wright frequently said to me in our conversations, "If one could only constantly differentiate intelligently, diagnosis would be easy." 3. Anatomy of the body was taught for over 1250 years from the writings of Galen and we have seen the famous Dutch painting of the anatomists demonstrating the tissues and especially those of the hand. Galen was accepted and must be right. But in recent times it has been definitely proven that his anatomical description of the hand was not that of a human, but that of a monkey. The authorities are to be accepted, but prove them.

In conclusion, permit me to use the same quotation from Emerson that Nicholas Murray Butler used in ending his presidential report for 1931 to Columbia University, "Be an opener of doors to those who come after you."

Symposium: Evaluation of Roentgenology in Otolaryngology.

- a. **The Temporal Bone and Its Variation.** Mr. E. Burchell (by invitation).
- b. **Teeth.** Dr. S. Fineman.
- c. **Sinuses.** Dr. Frederick M. Law.
- d. **Mastoid.** Dr. Geo. S. Dixon.
- e. **Larynx.** Dr. Ross Golden.
- f. **Bronchi.** Dr. Leon T. LeWald.
- g. **Esophagus.** Dr. A. Judson Quimby.
- h. **Chest.** Dr. Leopold Jackes.

(To be published in a subsequent issue of THE LARYNGOSCOPE.)

DISCUSSION.

DR. M. C. MYERSON: The Chairman was good enough to ask me to discuss the larynx in this symposium. It occurs to me that when a procedure comes into the practice of medicine and is dropped, there is usually a reason for it. I am not a pessimist on the subject of Roentgenology of the larynx, but it is a fact that until Pancoast and Pfahler, of Philadelphia, called attention to X-rays of the larynx recently it had been neglected for many years.

Our experience has led us to divide Roentgenology as pertains to the larynx into three groups: The first includes those cases in which the X-ray has a definite value; the second, those in which it has a confirmatory value; and the third, those in which it has no value at all.

The number of cases in which the X-ray has a definite value is very limited. We can readily see that the X-ray can assist us in understanding and appreciating the lower limit of a lesion and some unexpected condition, such as a congenital abnormality or air in the tissues. When all is said and done, the laryngologist as a clinician must be able to diagnose a great majority of the laryngeal lesions he encounters. It is only when an obscure lesion which he does not understand, or the lower limit cannot be diagnosed, that the Roentgenogram can be of value to him.

In another limited class the Roentgenogram may be and is of value, where we meet with conditions not detectable in the tissues we examine. Recently we encountered a lady who had swallowed a spicule of chicken bone which lodged in the larynx; she presented herself with a swelling of the retropharyngeal tissues. The swelling increased and after two or three days a Roentgenogram showed a collection of fluid and gas in the retropharyngeal space. She had an anaerobic infection. The bacteriologic study revealed the same anaerobic organisms as are found in putrid lung abscess.

I don't know what the film Dr. Golden showed is, but it may represent a patient whom Dr. Imperatori and I and several others studied for a long time. This patient had a streptococcal perichondritis with a loss of part of one of her false cords. Dr. Coutard permitted himself to make a diagnosis of the laryngeal lesions on a basis of the X-ray film alone. One is treading a dangerous territory when he substitutes the reading of a film for clinical history and clinical observation and diagnosis.

I might call attention to the fact that frequently films show areas of calcification in the laryngeal cartilage. Several instances have been reported where the calcified shadow resembles a foreign body and has been interpreted as such. Several years ago I was badly mistaken before I finally stumbled upon the fact that the collar button which was represented on the film of a larynx was only a phantom shadow.

Finally, a Roentgenogram of the larynx should be considered as an adjunct to the clinical examination, and that only. A Roentgenogram of the larynx can be regarded as the graphic record of a case which is to be saved for the future.

DR. BISSELL B. PALMER: The close relationship between laryngology and dentistry, and the overlaps of one field upon the other in borderline cases, give these two specialties of health service much of mutual interest.

That the Roentgen ray is indispensable in laryngological and dental diagnosis is one fact on which I am sure we will all agree, and I shall not touch on this fundamental truth for, in a program as extensive as this one, I would feel uncomfortable in taking more than a few minutes for the discussion of my particular phase of the subject.

The value of the Roentgen ray in dental diagnosis is now so generally accepted that there would be no point in my emphasizing it before this group. Possibly, if I limit my discussion to a consideration of a few high points in Roentgen dental diagnosis of interest to the laryngologist, I will best meet the requirements of my particular part of your program.

We hear so much of the possibilities of the Roentgen ray in dental diagnosis that we are apt to overlook its limitations which are most apparent in three particular respects: First, in diagnosing pulpless teeth; and at this time I would like to indicate some limitations of the Roentgen ray in this particular field. The dental Roentgenogram will indicate pulpless teeth that have been subjected to root canal fillings of an opaque nature, but not otherwise. When a tooth has become pulpless from repeated thermal shocks or other injury, the condition is not detectable by Roentgen examination unless there develops subsequently a destruction of alveolar process at the apex of the tooth; therefore, we are unable to state definitely that a tooth is pulpless, unless we see evidence of root canal therapy in the Roentgenogram. All teeth having large and deep metallic fillings are particularly prone to the loss of vitality from thermal

shocks, and periodic testing of these teeth by an electric current is an important factor in diagnosis.

The second limitation in dental diagnosis by Roentgen rays is in respect to focal infections, for obviously the Roentgen ray will disclose only the results of infection and not the infection *per se*. We know from clinical experience and bacteriological examinations that a high percentage of teeth that have been pulpless a long period of years yield positive cultures, even though the Roentgenogram be negative. This is accounted for by two factors: First, the angulation in exposing the film may be such as not to show an apical lesion even though it may exist; second, the type of organism present may be of the low-grade type that may be carried for years without causing sufficient damage to show in a Roentgenogram.

The third limitation of the Roentgen ray in diagnosis of particular interest to the laryngologist is that of predetermining whether a tooth perforates the floor of the maxillary sinus. Here again the factor of angulation is extremely important, and the shifting of the Roentgen tube as much as one-fourth of an inch may result in producing a negative that will show either an intact floor of the sinus, or what appears to be a perforation on its floor by one or more roots of a tooth. Standardization of the technique in this particular field would be of great value in diagnosis.

The two principal types of dental infection are *periapical*, arising from the apex of a pulpless tooth, and *periodontal*, emanating from the root surfaces and the surrounding soft tissues.

In the periapical type of infection, where there is no sinus established for drainage, the toxins are absorbed and, of course, may be related as any other toxins might be to the many lesions of interest to the laryngologist; however, when we are dealing with infections of the periodontal type we are confronted with the presence of frank pus in addition to a toxin absorption from a much larger field. The presence of frank pus in the mouth must always be of concern to the laryngologist, and the Roentgenographic diagnosis in these cases is not always definite.

There is one other type of dental infection of interest to your specialty and that is the coronal type, by which I mean the infection that is so commonly found around the crown of an unerupted or impacted third molar. The Roentgenograms in these cases may only show a slightly malposed tooth, and do not often show indications of the existing infection. It is probably no exaggeration to state that soft tissue infections in the region of the third molars have caused more complications in laryngological diagnosis and treatment than any other dental factor.

In closing these remarks, I would like to point out that it has been my experience that the dental Roentgenograms properly angulated never exaggerate conditions. Frequently, however, they do fail to show the full extent of destruction from infection. It is also my opinion that in the dental, as well as in some other fields, the Roentgen ray should be looked upon as an adjunct to diagnosis and not the diagnosis itself.

DR. LUTHER B. MACKENZIE: I have learned tonight from the eminent archaeologist who is masquerading as your Chairman that rhinology is a very old subject, and that Moses was an early practitioner of this art. I am sure that Moses knew nothing whatever of the inside of the chest; but the outside of the chest, the bony thorax, was known a long time ago. And lest I seem to yield the priority too readily, I would remind you that Adam had one of his ribs investigated.

There is no department of medicine that is more indebted to Roentgenology than that of the chest—probably too much indebted. It is said that there is no evil without some good; it may also be said that there is no good without some evil, and the evil here is that we have come to depend too much upon Roentgenological aid and the science of physical diagnosis is falling into disuse and neglect. To point a moral and adorn a tale, may I cite a case which occurred in a New York hospital, where a nurse went to the internist and said: "I get tired very easily." "Have you lost any weight?" "No." "Any cough?" "No." "Any fever or expectoration?" "No." "Let me look in your throat. You have

diseased tonsils"; and he turned the nurse over to the throat specialist, who said: "You have diseased tonsils but you should have an X-ray picture of the chest before they are taken out." I will show you the plate which shows extensive bilateral disease (slide). While this case should have been recognized clinically, there are, however, undoubted cases of tuberculosis that give practically no physical evidences to the examiner and can be diagnosed only by the X-ray. On the other hand, through poorly made plates and those incorrectly interpreted, we all see cases diagnosed tuberculosis which later prove to be nontuberculous.

While the radiogram is very valuable in the diagnosis of tuberculosis, as has been indicated, it is more valuable for noting the progress of the disease. And, for the therapeutic procedure of artificial pneumothorax, it is indispensable. In cavity cases, which are always a menace, it is always the endeavor, through the collapse therapy, to close the cavity. Without the aid of the Roentgenogram it would be impossible to pass on the condition of the cavity. I will show you this slide (slide). This lung previously had a large cavity, which, as you can see, has collapsed under compression. The second slide shows a similar condition (slide). This cavity has been kept closed for a period of over two years. There is reason to hope that these cavities will be obliterated.

I have spoken above of collapse in which the lung was compressed into the spinal gutter, and Dr. LeWald has referred to the confusion that exists in regard to the terminology of massive collapse and massive atelectasis. It is true that in both instances the lungs are airless, but in other respects they are very dissimilar. As I have shown you, in massive collapse the lung is small, compressed in the spinal gutter; the mediastinum is displaced away from the affected side and the pleural space is greatly enlarged. In massive atelectasis, on the other hand, while the lung is somewhat diminished in size, it is but very little. The air vesicles are filled with a transudate—the so-called drowned lung; the displacement instead of being away from is towards, and the pleural is about normal in size. The conditions are distinct and it seems to me that there should be no confusion (slide). This is a case of a bronchial carcinoma (proven by biopsy) in which a massive atelectasis of the lung has occurred.

I should like to say just a few words on the subject of the increase of cancer of the lung. In recent literature it is pointed out that the number of cases being reported is greatly on the increase, but that it is more apparent than real. The former scarcity is explained on the grounds of failure of recognition, and it has been repeatedly pointed out that the clinicians have been largely responsible. I cannot accept this reasoning as valid but believe that bronchial cancer, for some as yet unexplained reason, is really largely increasing. Clinicians' views, as well as the Roentgenologists', on the frequency of primary cancer of the lung should be gathered from postmortem statistics, and in a review of these statistics in Bellevue Hospital from the years 1904-1914 the protocols were thoroughly searched, and not one case of primary cancer of the lung was found. This was during the occupancy of Dr. Charles Norris, and it was his judgment that not a single primary carcinoma of the lung has come to the postmortem rooms of Bellevue during this time. During recent years primary cancer of the lung is a very common finding at the postmortem table, and recently we have had as many as three in one week. In fact, one of the younger pathologists in Bellevue recently stated to me that in his judgment primary cancer of the lung was the most frequent primary neoplasm encountered. Similar reports are coming from every pathological institution all over the world, and all are at a loss to explain it. Tar on the streets and the influenza epidemic of 1918 have at some time or other been put forward, but in reality no valid explanation for the increase of pulmonary cancer has been found.

DR. L. T. LEWALD: Lung abscess is sometimes said to follow tonsillectomy. In the first case of lung abscess which I showed, the patient had had his tonsils taken out to stop his cough, which really was due to his lung abscess; but in the hospital the interne in recording the history turned the facts around and made it read as if the tonsillectomy had preceded the lung abscess, whereas the reverse was true. In other words, this case is a proven case of lung abscess which did *not* follow tonsillectomy.

MINNESOTA ACADEMY OF OPHTHALMOLOGY AND OTO-LARYNGOLOGY.

SECTION OF OTO-LARYNGOLOGY.

Meeting of Jan. 15, 1932.

Dr. John F. Fulton (by invitation) presided.

The regular monthly meeting of the Minnesota Academy of Ophthalmology and Oto-Laryngology was held at the University Hospital on Friday evening, Jan. 15, 1932. The meeting was called to order by Dr. F. E. Burch, who then asked Dr. Fulton to preside.

Fistula of the Frontal Sinus. Dr. J. A. Pratt.

DISCUSSION.

DR. GEORGE E. MCGEARY stated that this patient had been head nurse at the Student Health Service, and complained one day of very severe headache. X-rays were taken which showed both maxillary sinuses definitely blocked. She then brought out X-rays taken over a period of five years, which showed exactly the same condition. On puncture, both maxillaries were discovered to be full of pus. These were operated and windows put in. In about five months' time they cleared up. About six months after the maxillaries were clear she developed an abscess below the right eyebrow in the midline of the orbit. This was very tense and very painful, and almost ready to rupture, so it was opened and a large amount of mucopus was evacuated, proving that there was a fistula through the bone. The patient objected to radical operation of the frontal sinus when the danger to the pulley of the superior oblique was explained, and Dr. Pratt was asked to see the patient.

Case 1: Fibroma of the Nasopharynx; Case 2: Carcinoma of the Pharynx.

Dr. L. R. Boies.

Case 1: This is a case of a fibroma apparently originating in the vault of the nasopharynx from the base of the sphenoid bone. The patient is a 15-year-old boy of Russian parentage. He was first seen in the Out-Patient Department in October, 1931. Two months previously, he had been treated by a physician in another State. A letter from the physician indicated that it was thought to be a "soft, round-celled fibroma" with attachment above the posterior end of the left middle turbinate, and that two radon seeds of one-half millicurie each had been inserted into the suspected site of attachment.

When first seen here, a hard, grayish-white tumor mass projected down behind the soft palate a little to the left of the midline. It practically filled the nasopharynx and pushed the uvula forward. Nasal respiration was shut off. A biopsy revealed the tumor to be a dense, fibromatous structure with early angiomatous change. X-ray study indicated no definite sinus involvement of the sphenoid or posterior ethmoids. He had, as might be expected, a rhinitis and bilateral maxillary sinusitis. (Lantern slides were shown.)

These tumors are comparatively rare. They are more common in males, become evident around the age of puberty and apparently regress after the age of 25 years. Though microscopically benign, they are potentially malignant, in that they invade the base of the skull. The origin is most commonly from the sphenoid bone. The attachment may be a pedunculated one or by a broad sessile base.

The earlier method of treating these tumors was by an evulsion of the growth from its attachment. The mortality was high, due to hemorrhage. With the increased use of radium in tumor treatment, surgery was more or less abandoned. New reported, in 1925, results in 32 cases. Between 1910-1915 eight patients were examined, five of which were operated by the evulsion method. There were two surgical deaths and the other three were not traced in the follow-up. From 1915-1924, 24 cases were examined, and all but one was treated with radium. Of the 23 cases so treated, 15 were considered cured, four were still under treatment, and four were not traced.

In planning the treatment for this particular case, it was decided to remove as much of the tumor mass as possible by coagulation and excision with diathermy, then to follow up with radium. This was done on Nov. 15. The approach was entirely through the mouth. Bleeding was easily controlled by coagulation before excision. As much of the growth as could be seen under direct vision was removed and the base coagulated. Nitrous oxid anesthesia is the anesthetic of choice in these cases but, due to inability to get a nasal tube of sufficient size by the tumor mass and into the trachea, chloroform inhalation was used in this case. Recovery was uneventful.

Three weeks later, the healed-over base of the original attachment was implanted with six emanation seeds, two by way of the nasal fossa and the rest through the mouth, supplying a total of 942 millicurie hours of emanation. Cocain anesthesia was used. There has been a gradual decrease in the amount of the tumor remains since. The patient can now get air through his nasal passages, although this is influenced to some extent by a residual rhinitis and sinusitis. It is planned to use more implants in the course of time.

Case 2: This woman, age 57 years, was first seen in the Tumor Clinic in February, 1931. At that time she had a firm, fixed tumor mass about the size of a hen's egg in the left side of her neck, about the middle part of her sternomastoid muscle. She gave a history of onset of the swelling eight months previously. It had gradually increased in size and had been treated externally by her family physician by the use of an ointment.

Dr. Boies said he first saw her in June. Examination at that time revealed a small area of suggestive proliferation low on her left lateral pharyngeal band. Biopsy was taken and returned as a squamous-celled carcinoma, Grade III. An implantation was then made around this area, using six seeds, supplying 950 millicurie hours. In the early part of August, a small palpable node was detected below the site of the original swelling in the neck. She had discovered this herself because it had become tender. Eight seeds, supplying 1,056 millicurie hours, were inserted around this node, and another course of X-ray treatment was given. In October, another small area of proliferation was noted in her pharynx adjacent to the original lesion. This was implanted with three seeds, supplying 449 millicurie hours of emanation. A biopsy taken at the same time was negative, however. One month later, another biopsy taken from the lower margin of the original site was positive. She was then admitted to the hospital and, under Avertin anesthesia, through a direct laryngoscopic view, nine seeds, supply 1,558 millicurie hours, were implanted deep in the pharynx.

The interesting features of this case are: 1. The small primary lesion with the large secondary growth in the neck; 2. the fact that, except for the discomfort caused by the radium reaction, she had maintained her weight and strength and a sense of well-being; and 3. that it is now approximately one year and seven months since she first noted the swelling in her neck, and in that time has received a total of 6,257 millicurie hours of radium emanation, a rather large dose.

DISCUSSION.

DR. GEORGE C. DITTMAN said in this connection he recalled a case he had of a 5-year-old boy, who had a tumor mass which protruded from the left nostril, which very much resembled a finger. The diagnosis proved to be fibrosarcoma. Under general anesthesia this tumor was removed with a snare but there was considerable bleeding following it. Dr. Dittman said he then recommended that the patient have radium applications. He later heard that the patient had died from brain complications.

DR. W. E. CAMP asked Dr. Boies if he could pick out the area where the carcinoma originated.

DR. BOIES stated it was squamous-celled carcinoma and therefore infiltrating only in the sense of involvement of the mucosa of the pharynx from where it metastasized to glands in the neck.

Presentation of the Year's Work in Bronchoscopy at the University Hospital; the Number and Types of Cases Seen and the Results of Treatment. Dr. Kenneth A. Phelps.

MINNESOTA ACADEMY OF OPHTHALMOLOGY AND OTO-LARYNGOLOGY.

SECTION OF OTO-LARYNGOLOGY.

Meeting of April 8, 1932.

Dr. Douglas Wood, President, Presided.

Radical Sinus Exenteration in Pansinusitis, With an Analysis of Fifty Cases as to Results Obtained. Dr. E. L. Armstrong.

Fifty patients with a diagnosis of pansinusitis were operated on with a complete exenteration of the nasal sinuses, first opening into the antrum through the cheek, as in a Caldwell-Luc operation, and then through the roof of the antrum into the ethmoids, frontal and sphenoid, removing the entire floor of these cells and very thoroughly curetting these cells (frontal, ethmoid and sphenoid) all out. The bony wall between the nares and antrum was also removed, leaving the middle and inferior turbinates as two ribbons or bands stretching across between the nasal cavity and the antral cavity. Hypertrophied turbinates, especially the inferior turbinate, can be made smaller by biting off along the previously attached portion of the turbinate.

This operation was first performed by Uffenorde in 1912, who found he was not able to prevent the reformation of polypi after a complete intranasal ethmoid exenteration. Also the external ethmoid and frontal exenteration did not stop the resurgence of polypi, but by attacking the ethmoids through the antrum he was able to stop the recurrence of polypi.

This operation is also performed by Dr. Sewall, of Stanford University, who advises first performing constructive surgery, such as tonsillectomy and septum removal, and then waiting quite some time before attacking the sinuses as many cases will then clear up. (My own previous check-up by questionnaire on septum surgery has shown that 42 per cent will respond to septal resection alone.)

An analysis of 50 cases was made according to symptom-complex, the operation having been performed three years or more ago, thus allowing for considerable time to elapse in order to check the end-results several years following surgery.

In these 50 cases, 29 were recorded as cured, 18 as improved, and three as not improved. None was made worse.

Analysis According to Symptoms: Discharge: Twenty-one patients with this as a major complaint. Eleven are recorded as cured, eight as improved, and two as not improved.

Nasal Blockage: Eleven cases of polypi, with no recurrence following operation in any case. Fourteen cases of blockage other than polypi, with 13 recorded as improved, and one not benefited. However, many of these cases also had septal resections, especially where there was any marked deviation of the septum.

Focal Infection: Eleven cases were operated primarily to benefit some condition dependent on a foci as a causative agent. Of this number, 10 showed some degree of improvement, and one showed no improvement.

Bronchiectasis: Four cases, all with some improvement. One case improved very much with lipiodol treatments following the operation. One other case improved much with pneumothorax collapse therapy.

Bronchitis: Four cases. Two of the cases, of rather mild degree, were cured; two cases were improved.

Asthma: Five cases. In all, the nasal symptoms were improved; one case was cured, one very greatly improved (handling dusty hay was the only thing that gave any difficulty). Two patients felt that they were some better. One, who did not have any nasal symptoms, although the sinuses were all crowded with polypi, which had not as yet been forced out into the nose, was not improved. Follow-up treatment with vaccines, lipiodol fillings of the chest, etc., will greatly help many of these.

Emphysema: One case was greatly benefited, and two much improved, by the surgery.

Headache: Ten cases in all who complained of headaches of some degree. Of this number, six were relieved completely, three were improved, and one still reported an occasional headache.

Of the 42 cases, nine had had previous nasal surgery, two cases having had a Caldwell-Luc operation with no benefit. Three cases had followed tooth extractions, but the other sinuses were also diseased, and three of the cases complained of some local pain in the cheek.

Conclusions: When the difficulty is confined to the sinuses, the results are very good. Where there is a complicating bronchitis of not too long standing, or too much pathology has not already developed in the bronchial tree, the results are also gratifying. In cases of bronchiectasis, improvement will result if the lungs will respond to treatments such as the lipiodol injection. Vaccines, drugs, climate, etc., are quite important.

In asthmatics the asthma may not be influenced much, but the nose is made much more comfortable. Here, follow-up treatment is very essential. This operation seems to cure polypi completely, as in no case in this small series has there been a recurrence such as usually follows other methods of polypi removal or sinus operations except, of course, the primary polypi which arise from the middle turbinate or furrows in the middle turbinate and which would be cured by simple removal. Polypi arising from a sinus are called "secondary polypi," being secondary to an infection in that sinus, usually of the serous catarrhal type. The empyemas do not usually result in polypoid formations.

Advantages of this type of operation are as follows: 1. It is done at one sitting, eliminating the frequent and prolonged curetting of the ethmoids, usually required by the intranasal route; economic considerations, etc., for patients from a distance. 2. A full view and inspection is possible of the entire ethmoid labyrinth and sphenoid and also up into the frontal sinus to some extent, so that all polyposis and necrotic tissue can be removed very thoroughly. 3. It creates one large sinus cavity of the antrum, ethmoid, frontal and sphenoid on a side, providing a very complete drainage and ventilation for any acute subsequent infection that may develop. 4. While this may sound like a formidable procedure, it is not in the least mutilating. The intranasal appearance of the nose, including the turbinates, septum, etc., is all perfectly normal. Not one of the patients has complained of any dryness, crusting or discomfort from the respiration of cold air. 5. The advisability of caring for the chronic cases of pansinusitis before bronchiectasis, asthma or other serious complications have developed, is imperative in order to get the best results from surgery. 6. This operation is advised only for cases of pansinusitis with extensive involvement, where simpler methods of treatment are not indicated.

DISCUSSION.

DR. W. E. CAMP asked if these operations are done under local or general anesthesia.

DR. ARMSTRONG replied, usually under local.

DR. CAMP asked if it was through the alveolar route.

DR. DOUGLAS WOOD asked how the nose was anesthetized; through the nose, or otherwise.

DR. ARMSTRONG replied, it was through the nose, blocking of the anterior ethmoid and sphenopalatine nerves with cocain, and injection of the novocain along the alveolar margin and up into the infraorbital nerve through the infra-orbital opening.

DR. C. N. SPRATT asked how long these cases had been observed; if Dr. Armstrong curetted every sphenoid; and what about the effect on the teeth of the upper jaw.

DR. ARMSTRONG replied that he did not curette the ethmoid unless there is infection. He thought the effect on the teeth was about the same as after the Caldwell-Luc operation. The case presented was done about three-and-a-half years ago. The postoperative convalescence is not at all severe in these cases; about the same as with the ordinary Caldwell-Luc operation.

THE NASHVILLE ACADEMY OF OPHTHALMOLOGY AND OTO-LARYNGOLOGY.

Meeting of Jan. 18, 1932.

Dr. Hilliard Wood, Chairman, Presided.

Unusual Case of Mastoiditis. Dr. W. G. Kennon.

Dr. W. G. Kennon reported the case of E. R., a white male, age 13 years, who consulted him ten days after the right ear had become painful and discharge had developed. There had been similar attacks previously; the last one one year before. With the recent attack there had been some listlessness, but no definite rise of temperature, chills or sweats. Two days before Dr. Kennon saw the patient a gradual increasing swelling occurred anterior to the right ear. The swelling progressed both anteriorly and posteriorly; the eyelids on the right side were extremely swollen. There was no redness and the mass was not tender. The patient did not complain of pain.

Examination of the right ear revealed a thick, purulent discharge from the external auditory canal. The membrana tympani could not be seen, except of the upper wall of the canal. An X-ray was not made. There was slight tenderness over the root of the zygoma and the mastoid antrum. Examination of the right eye revealed the swelling of the eyelids previously mentioned. The globe was normal, as were extrinsic and intrinsic muscles.

Diagnosis of mastoiditis was made and immediate operation was advised. At operation there was found over the upper part of the mastoid process a quantity of friable, partially organized exudate. When this was wiped away, the surface of the bone appeared normal. The periosteum was elevated forward to the root of zygoma, where a pocket of thick pus was found. The bone cortex was removed and the mastoid structure was found to be sclerotic. No cells, except the mastoid antrum, were found in the body of the mastoid bone. The antrum contained free pus. Anteriorly, towards the zygoma, a large cell was located just beneath the cortex, which contained free pus and edematous mucous membrane. The cortex over this cell was necrotic. It was thought that this point was the source of the subperiosteal abscess, and the cause of the peculiar sagging of the superior canal wall.

The wound was closed with added drain in the upper angle of the wound.

On the second day postoperative the edema about the right eye had subsided somewhat, but there was marked edema of the eyelids of the left side. The temperature gradually subsided from 103° on the first day postoperative; the edema gradually disappeared.

The interesting features of Dr. Kennon's case were: 1. The marked edema. 2. The unusual sagging of the external auditory wall. 3. The presence of the one large cell in the mastoid proper and the one cell in the zygomatic region, which is usually pneumatized in only the highly cellular type of mastoid process. 4. The migration of the edema to the left side, which was probably due to gravity; the patient had been lying on his left side almost continuously following the operation.

Meeting of March 21, 1932.

Dr. Hilliard Wood, Chairman, Presided.

Acute Frontal Sinusitis with Diploic Vein Thrombosis. Dr. Eugene Orr.

Dr. Eugene Orr reported a case of acute frontal sinusitis with diploic vein thrombosis. The patient, a male, age 14 years, had awakened on the morning of the day of which he was seen by Dr. Orr with a hard chill, accompanied by severe headache. During the week previous he had suffered with a cold. The patient's temperature was 105°; pulse, 120; respiration, 133. There was marked edema of the upper lid with conjunctival chemosis of the left eye. On the forehead above this eye there was a circumscribed area of swelling about two inches in diameter. There was definite tenderness over the frontal sinus region.

Intranasal examination showed congestion of the turbinates on the left side. Urinalysis showed a faint trace of albumin. Red blood cells, 3,200,500; white

blood count, 1720, of which 93 per cent were polyps. Blood culture, negative.

Following the use of ephedrine there was purulent discharge from the middle meatus on the left side, smears from which showed groups of staphylococci.

A few hours following the first examination the patient's temperature was 106° and he became irrational.

A neurological examination performed at this time disclosed negative findings. The patient's symptoms gradually subsided, under the continued use of ephedrine spray, and after six days the temperature was normal. There was continued profuse discharge from the middle meatus of the left side. The edema about the eye subsided remarkably. The cone-like swelling on the forehead became reduced in size.

The patient left the hospital on the sixth day; however, two days following this, Dr. Orr thought he was able to detect fluctuation over the mass on the forehead and the patient was readmitted to the hospital for operation. An X-ray at this time gave no information.

Under general anesthesia an incision was made along the eyebrow, care being taken not to disturb the periosteum of the anterior wall. An opening was made into the frontal sinus through the inferior mesial wall. The sinus was filled with pus, apparently under pressure. A drainage tube was inserted. An incision was made into the mass on the forehead through the periosteum. No pus was found. No other pathology of the bone could be demonstrated. Both skin wounds were closed with silk. The patient left the hospital on the fifth day. The mass had subsided; however, there was drainage through the tube for about three weeks. One month following the external operation, Dr. Orr performed an exenteration of the ethmoid cells and enlarged the nasofrontal duct to maximum capacity. This was done under local anesthesia. After a few days the external wound was allowed to close. The patient's recovery was uneventful.

AMERICAN ACADEMY OF OPHTHALMOLOGY AND OTO-LARYNGOLOGY.

The thirty-seventh annual convention of the American Academy of Ophthalmology and Oto-Laryngology will be held in Montreal, Canada, from September 19th to 23rd, 1932.

The program will consist of papers on Ophthalmology and Otolaryngology subjects, and a series of instructional presentations.

